#3

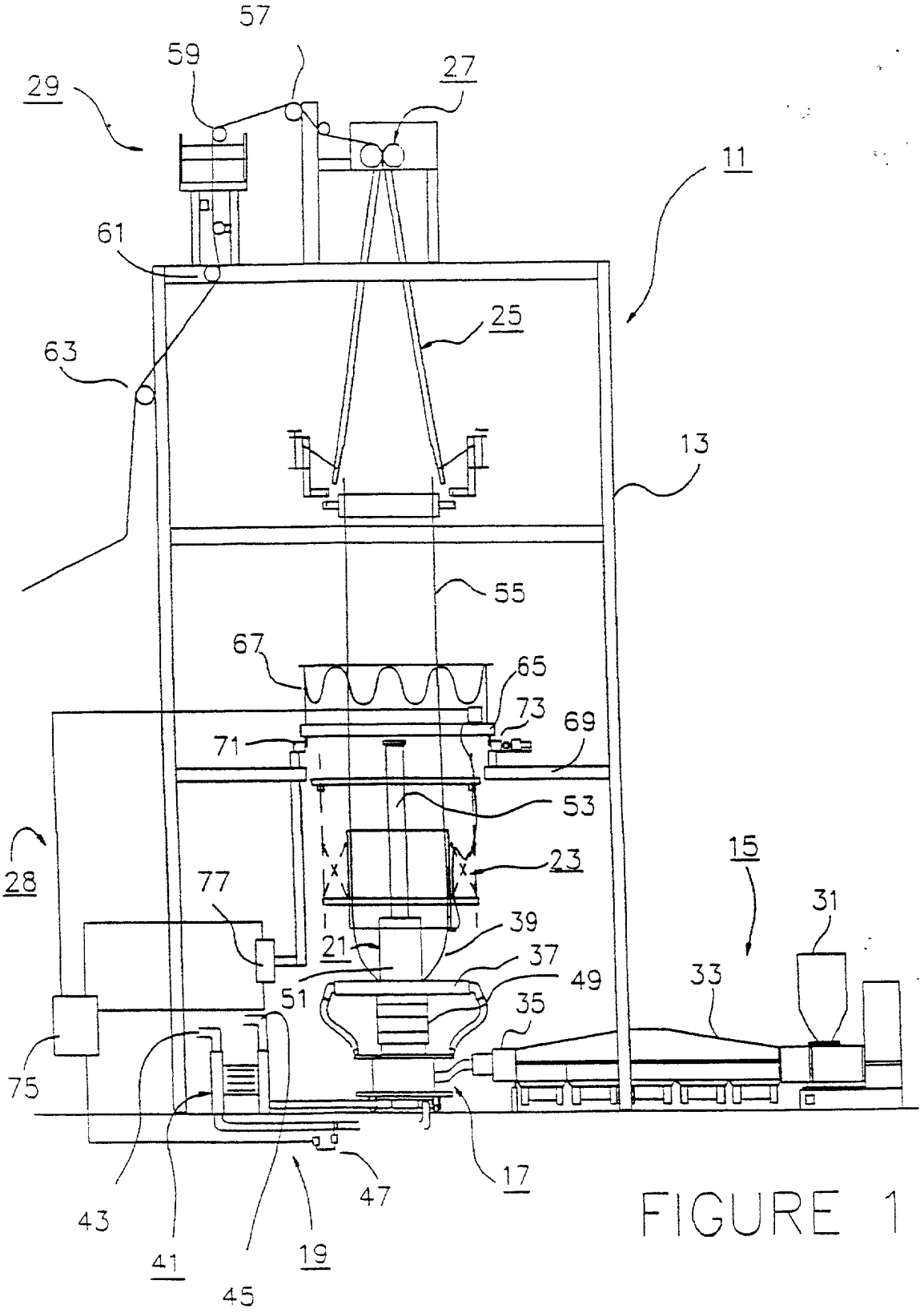

57
59
27
29
11
61
25
63
13
55
67
65
73
69
71
53
23
15
28
77
31
39
21
37
49
33
51
35
75
17
43
47
41
19
45

FIGURE 1

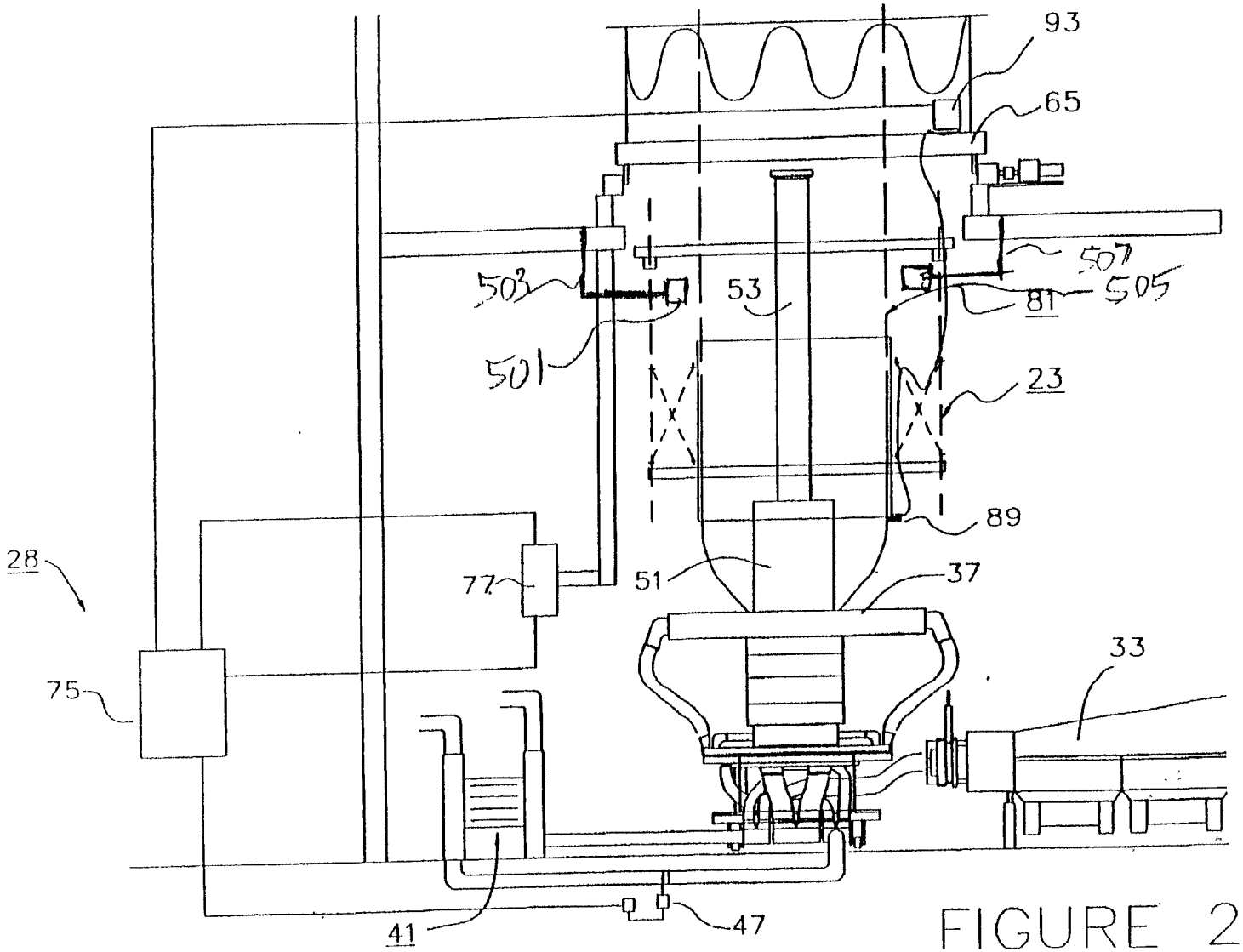


FIGURE 2

Patent "Patent 6,659,694

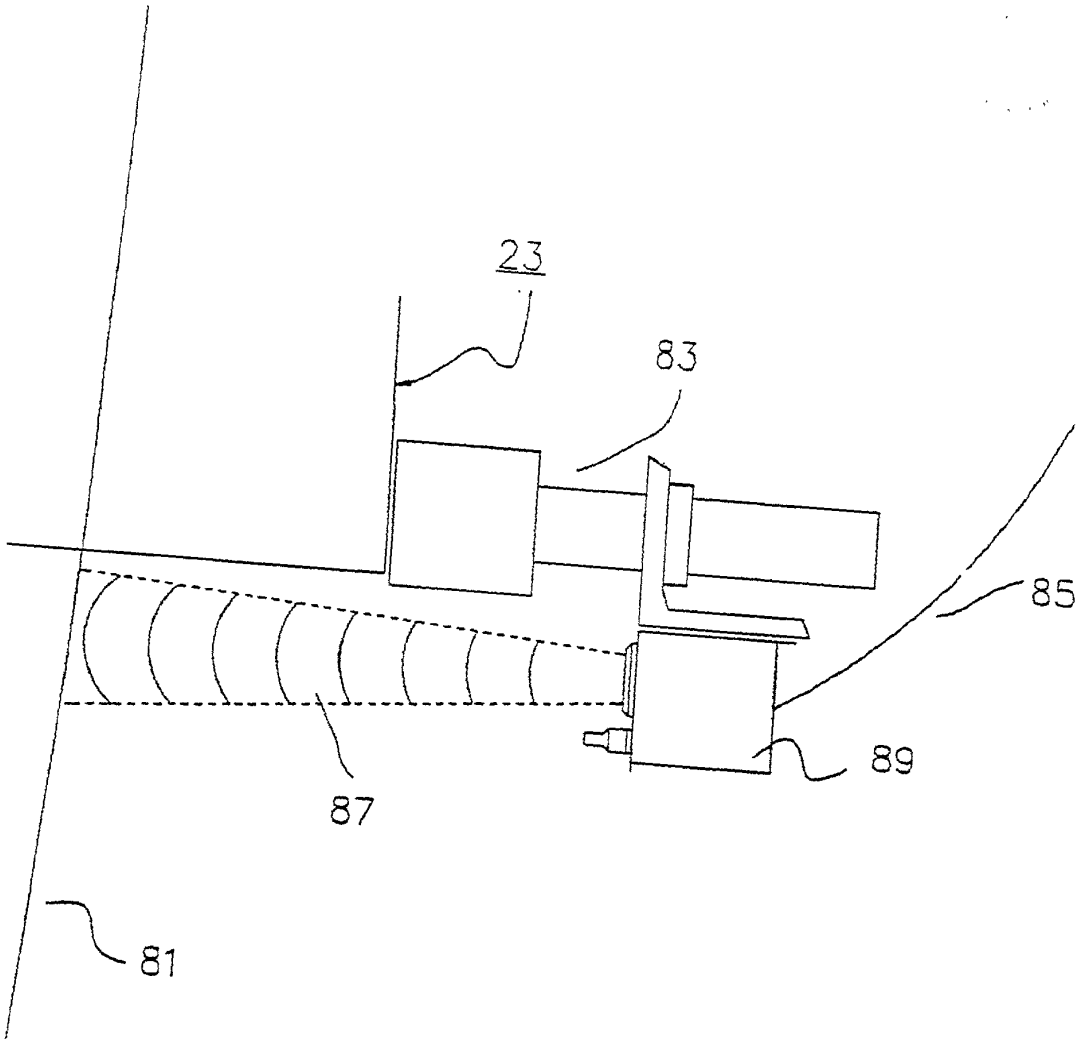


FIGURE 3

Document "4695464" - Page 4

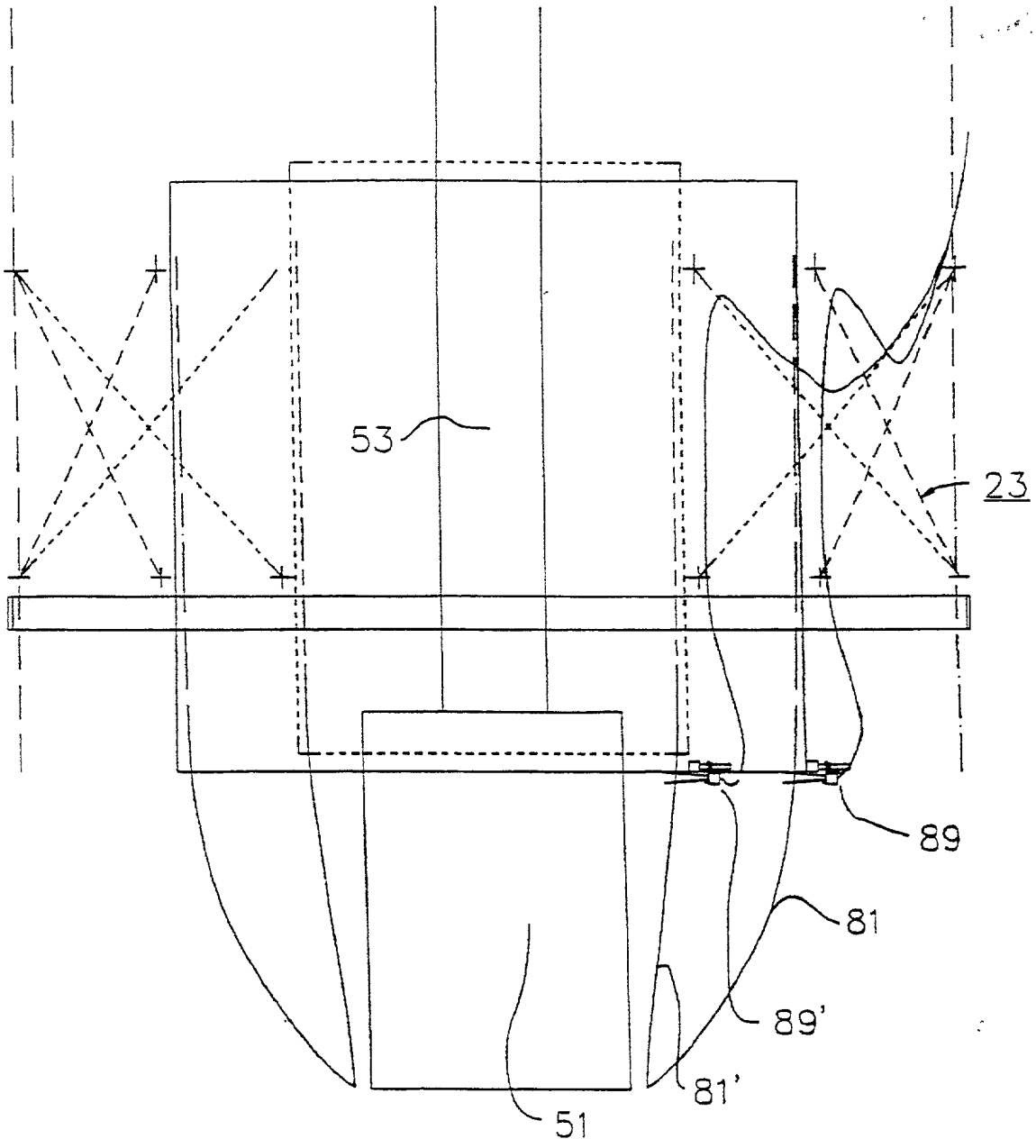


FIGURE 4

T09T80" hB062860

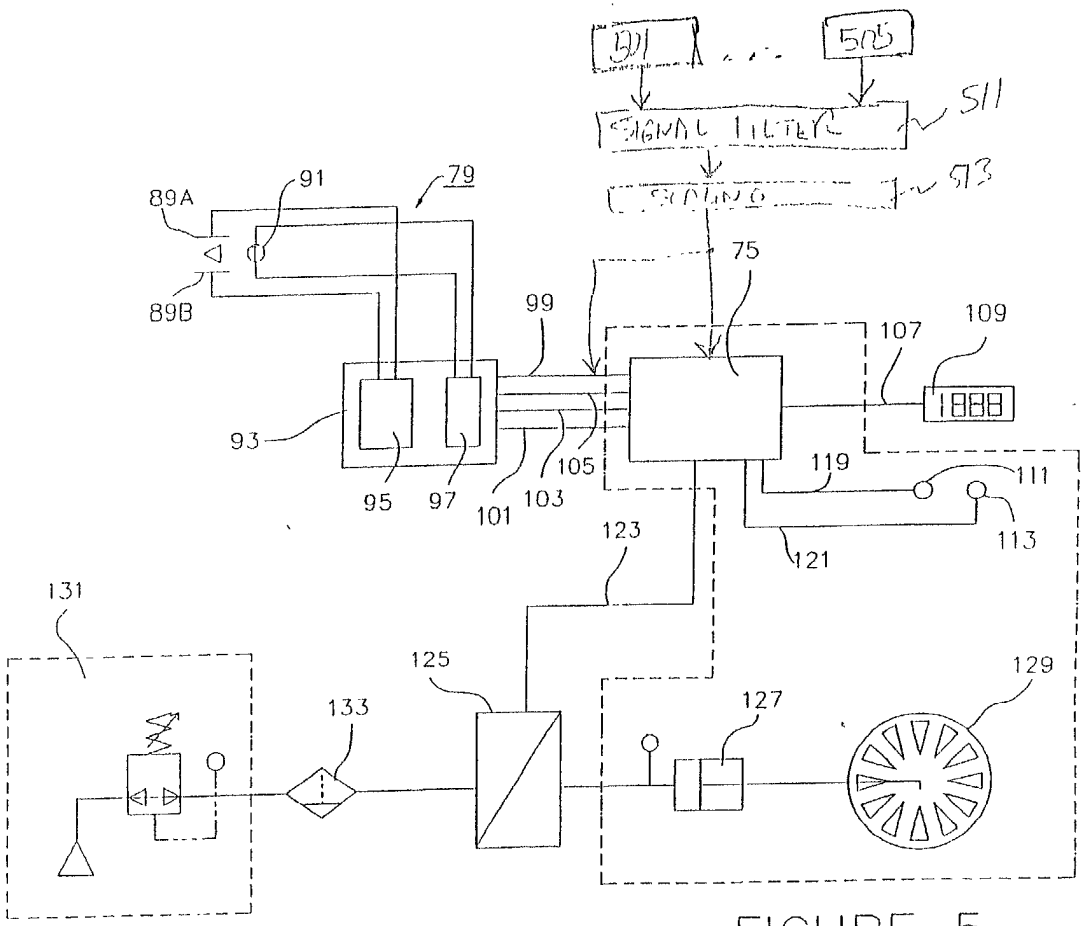


FIGURE 5

5,094,264

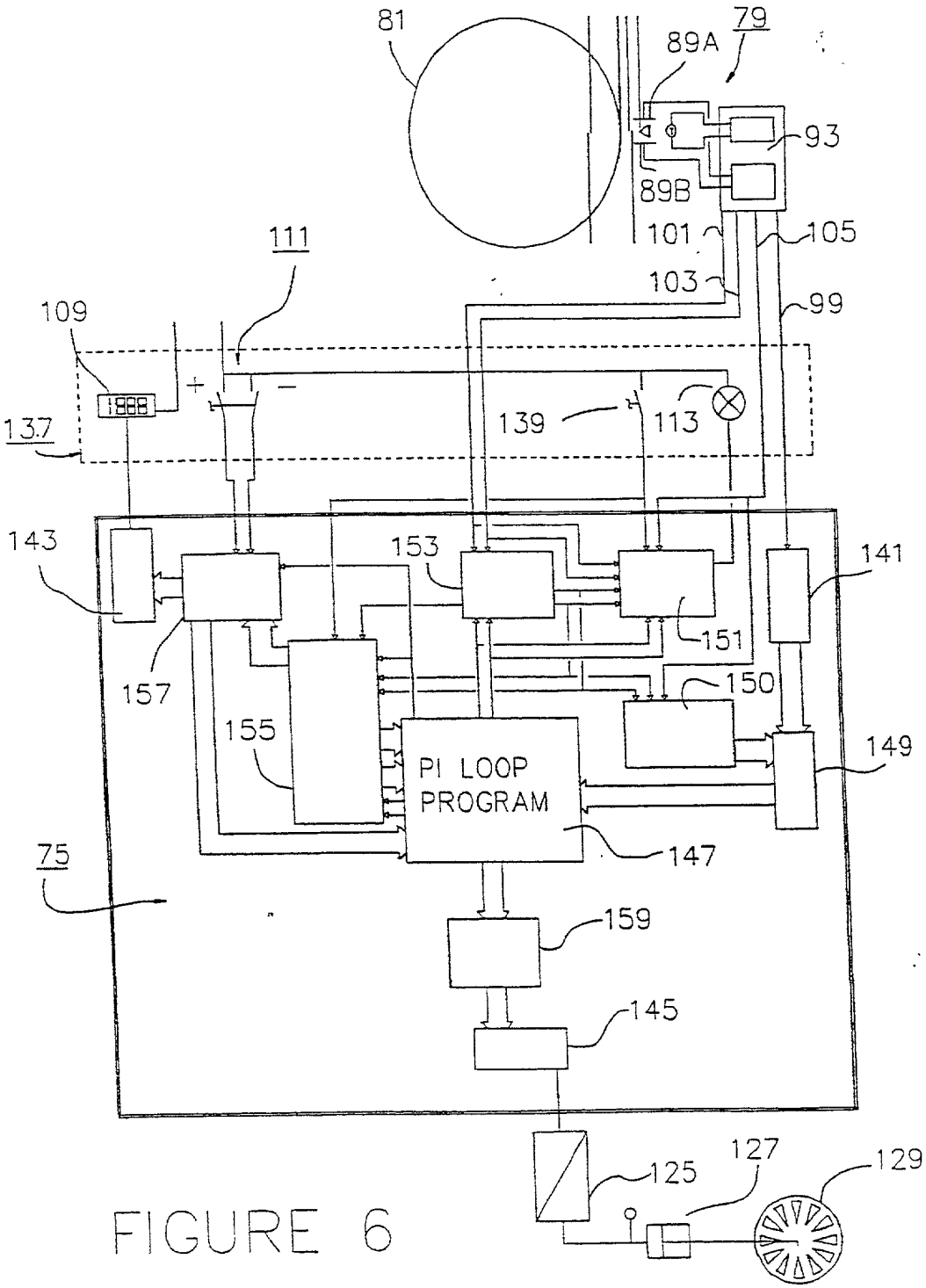


FIGURE 6

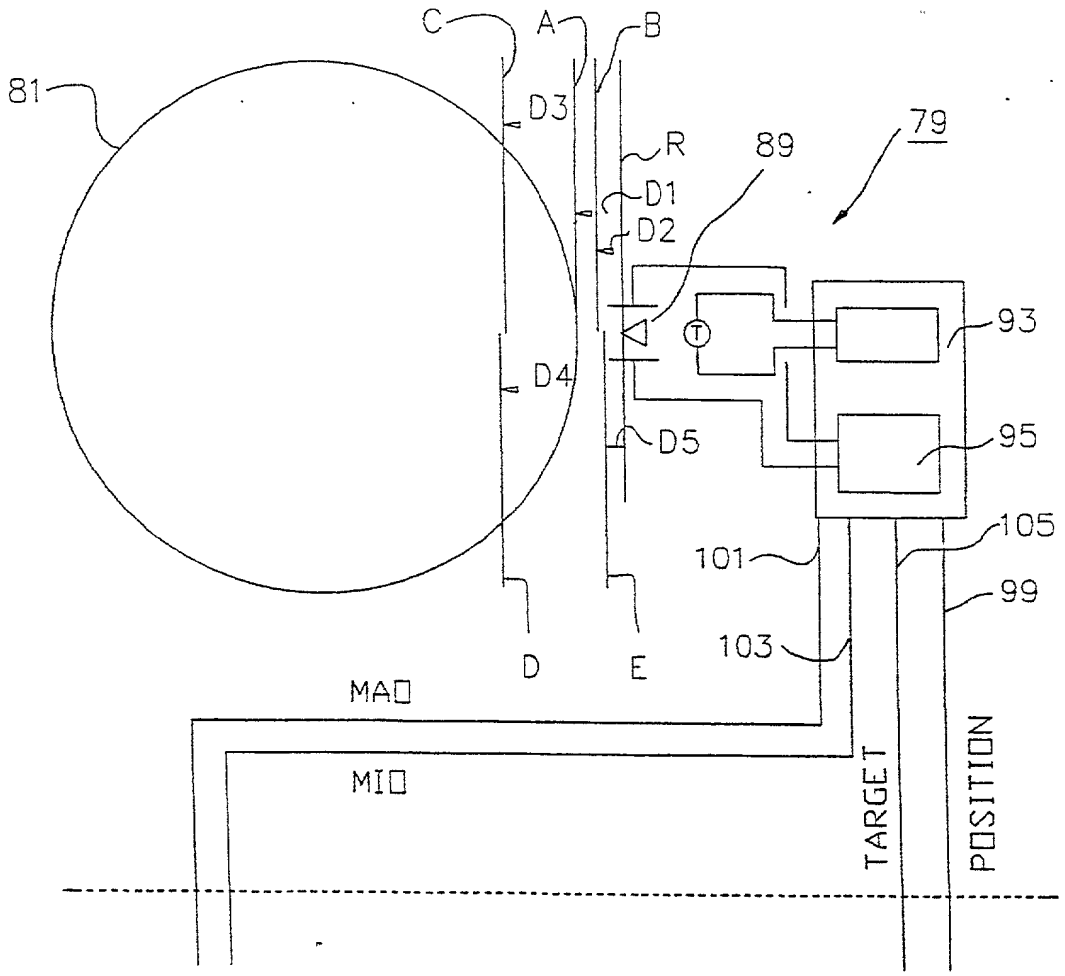

C
A
B
81
D3
R
89
79
D1
D2
93
D4
D5
95
105
101
99
103
D
E
MA□
MI□
TARGET
POSITION

FIGURE 7A

Document ID: US 6,095,949 A

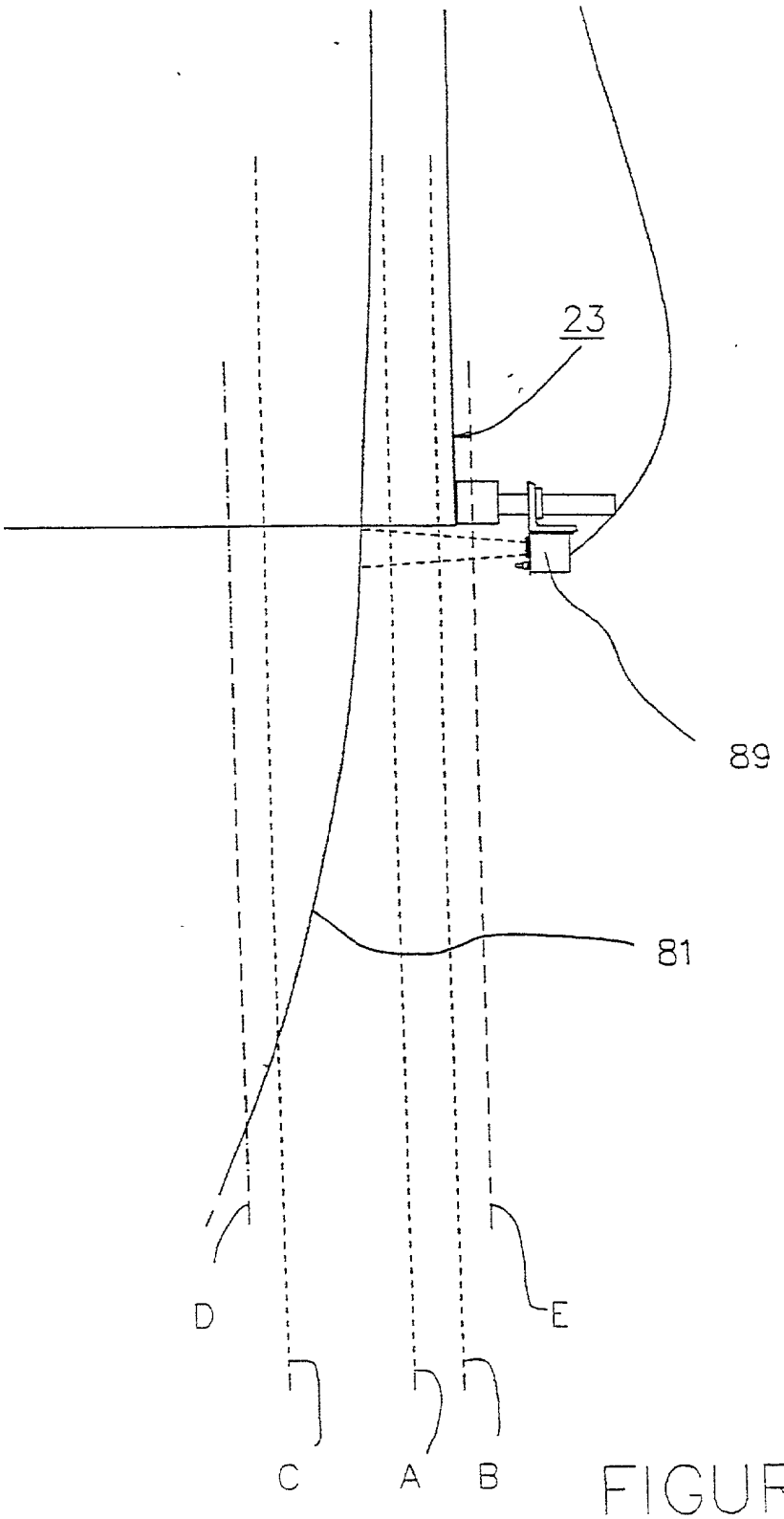


FIGURE 7B

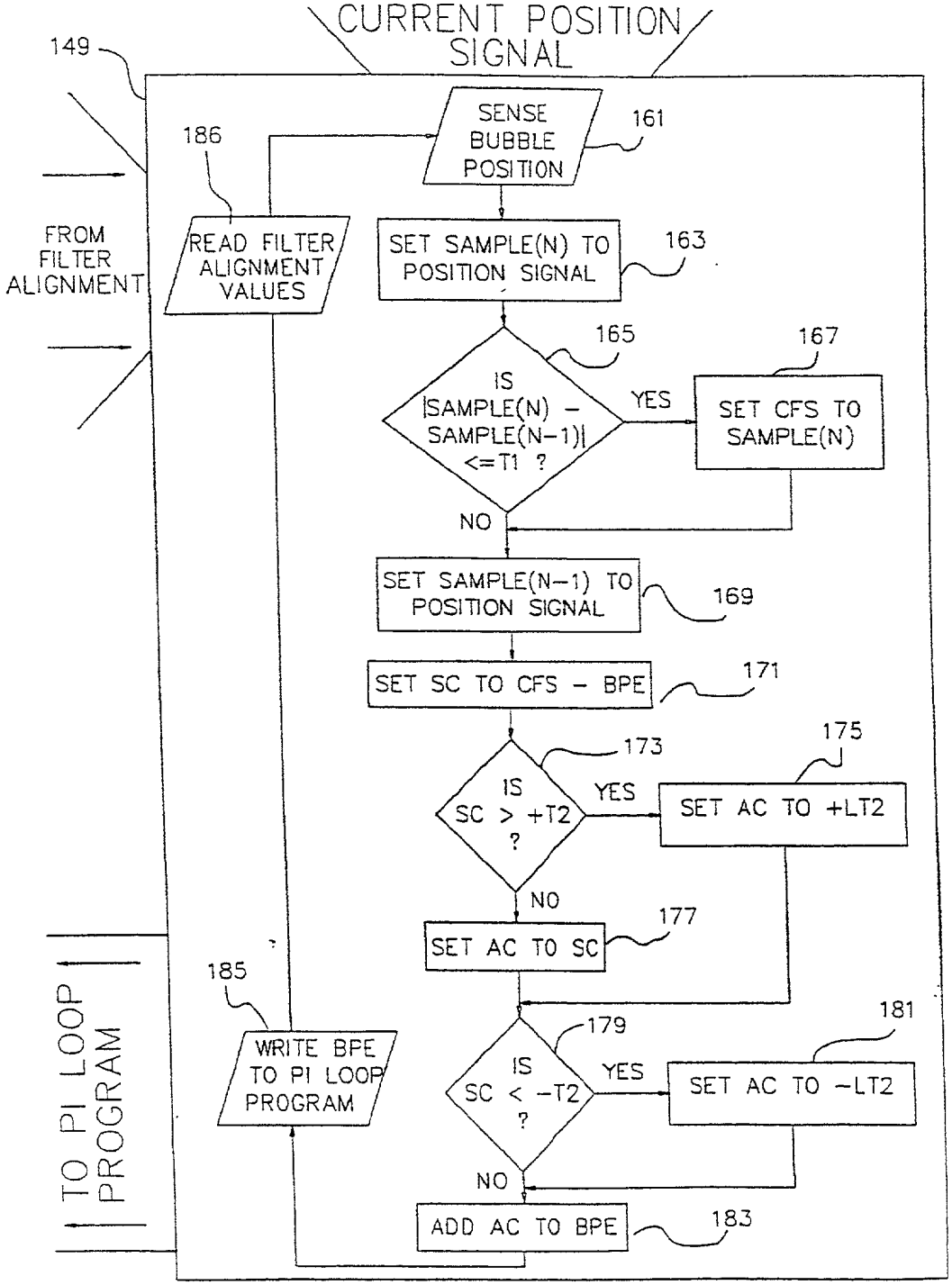

CURRENT POSITION SIGNAL
149
SENSE BUBBLE POSITION
161
186
FROM FILTER ALIGNMENT
READ FILTER ALIGNMENT VALUES
SET SAMPLE(N) TO POSITION SIGNAL
163
165
IS |SAMPLE(N) − SAMPLE(N−1)| <=T1 ?
YES
167
SET CFS TO SAMPLE(N)
NO
SET SAMPLE(N−1) TO POSITION SIGNAL
169
SET SC TO CFS − BPE
171
173
IS SC > +T2 ?
YES
175
SET AC TO +LT2
NO
SET AC TO SC
177
185
WRITE BPE TO PI LOOP PROGRAM
179
IS SC < −T2 ?
YES
181
SET AC TO −LT2
NO
ADD AC TO BPE
183
TO PI LOOP PROGRAM

FIGURE 8A

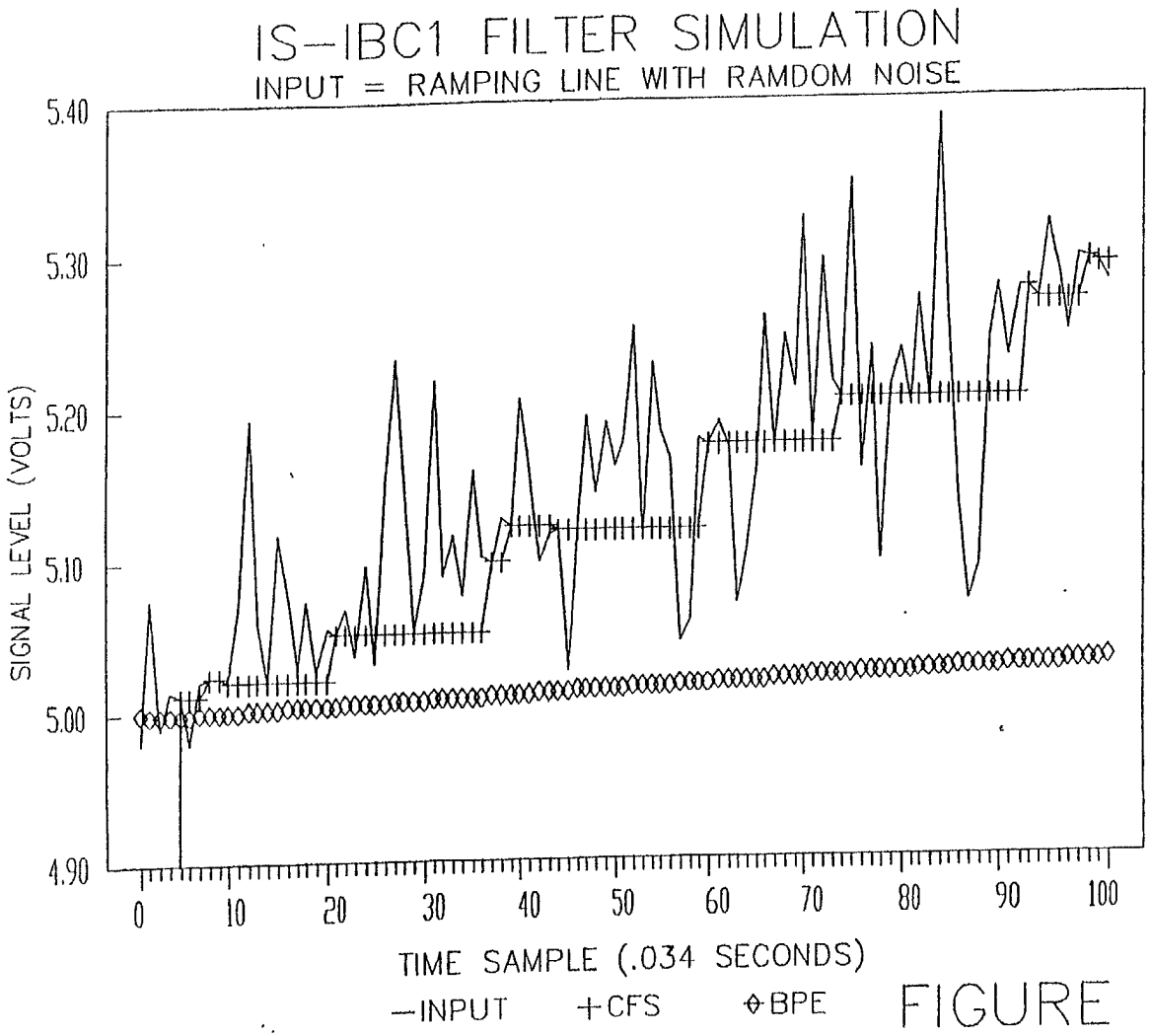

IS-IBC1 FILTER SIMULATION
INPUT = RAMPING LINE WITH RAMDOM NOISE
SIGNAL LEVEL (VOLTS)
5.40
5.30
5.20
5.10
5.00
4.90
0
10
20
30
40
50
60
70
80
90
100
TIME SAMPLE (.034 SECONDS)
—INPUT
+CFS
◇BPE

FIGURE 8B

Document: 3965964 - 09/15/2004

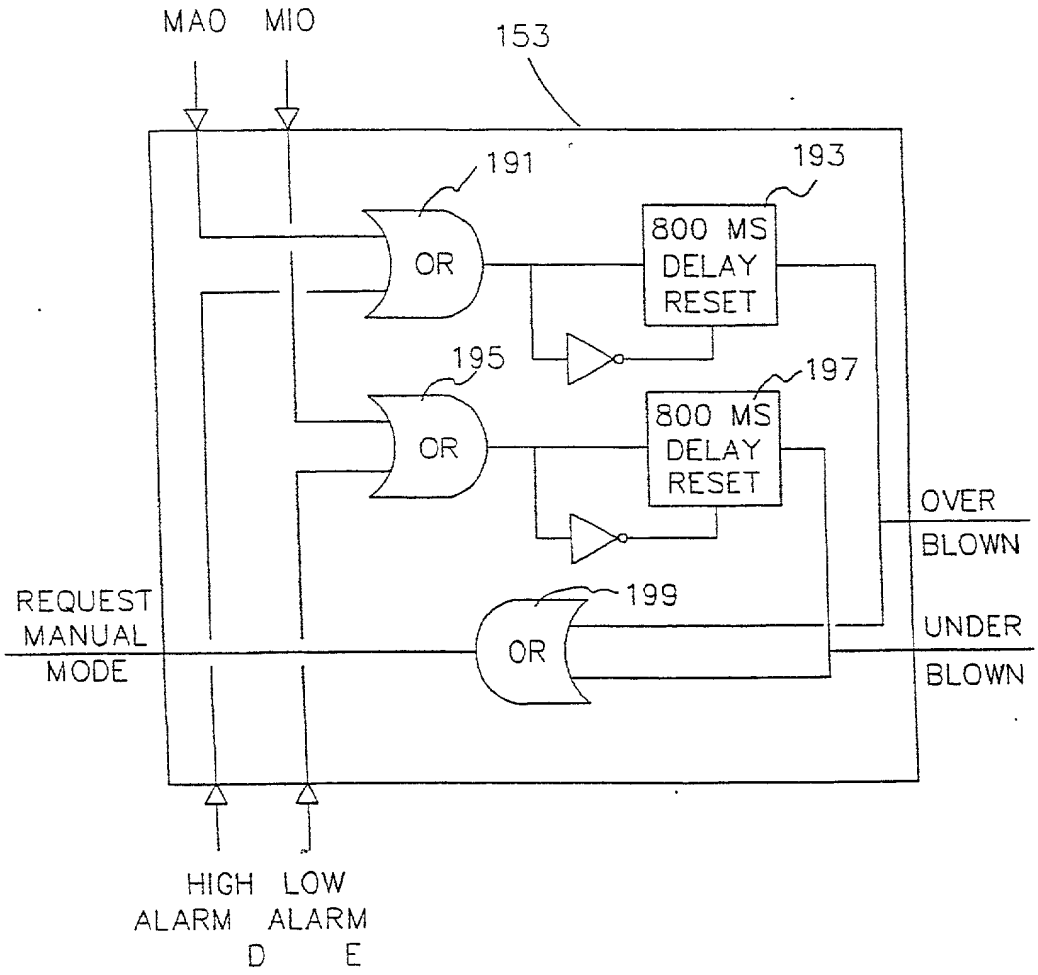


FIGURE 9

T09T80" tB0628B0

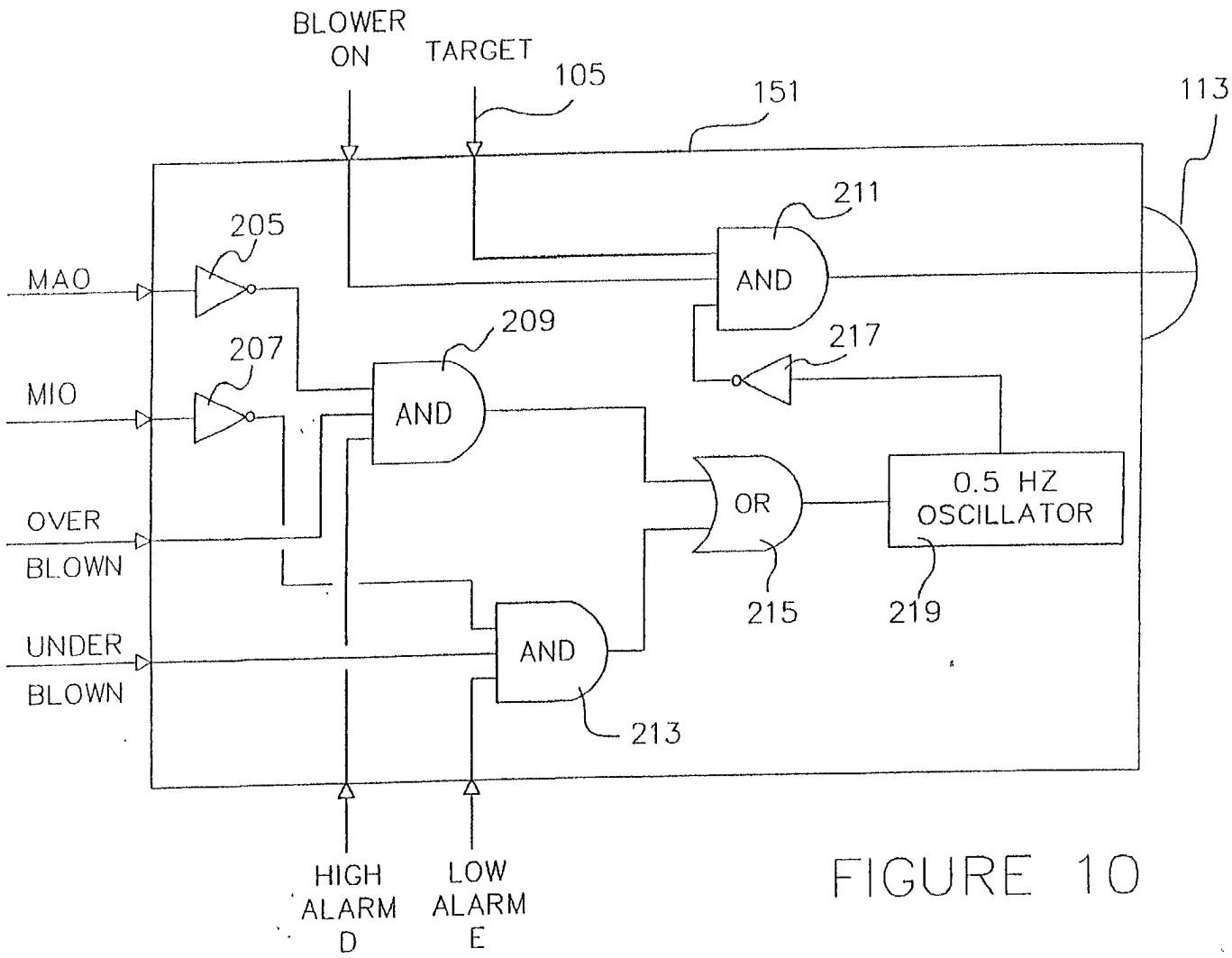


FIGURE 10

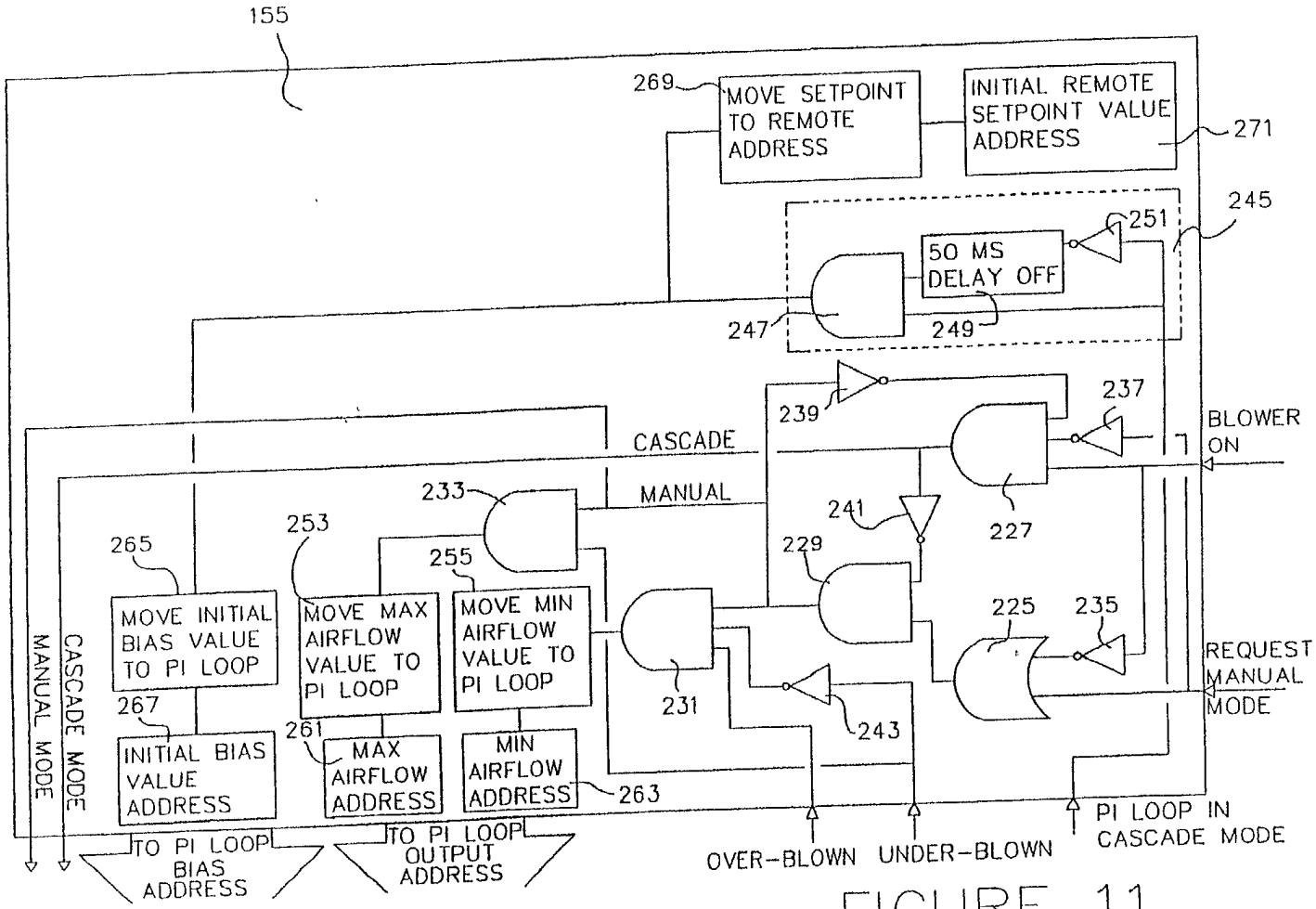

155
269
MOVE SETPOINT TO REMOTE ADDRESS
INITIAL REMOTE SETPOINT VALUE ADDRESS
271
245
251
50 MS DELAY OFF
247
249
239
237
BLOWER ON
CASCADE
MANUAL
233
241
227
253
265
255
229
225
235
MOVE INITIAL BIAS VALUE TO PI LOOP
MOVE MAX AIRFLOW VALUE TO PI LOOP
MOVE MIN AIRFLOW VALUE TO PI LOOP
231
243
REQUEST MANUAL MODE
267
261
INITIAL BIAS VALUE ADDRESS
MAX AIRFLOW ADDRESS
MIN AIRFLOW ADDRESS
263
MANUAL MODE
CASCADE MODE
TO PI LOOP BIAS ADDRESS
TO PI LOOP OUTPUT ADDRESS
OVER-BLOWN
UNDER-BLOWN
PI LOOP IN CASCADE MODE

FIGURE 11

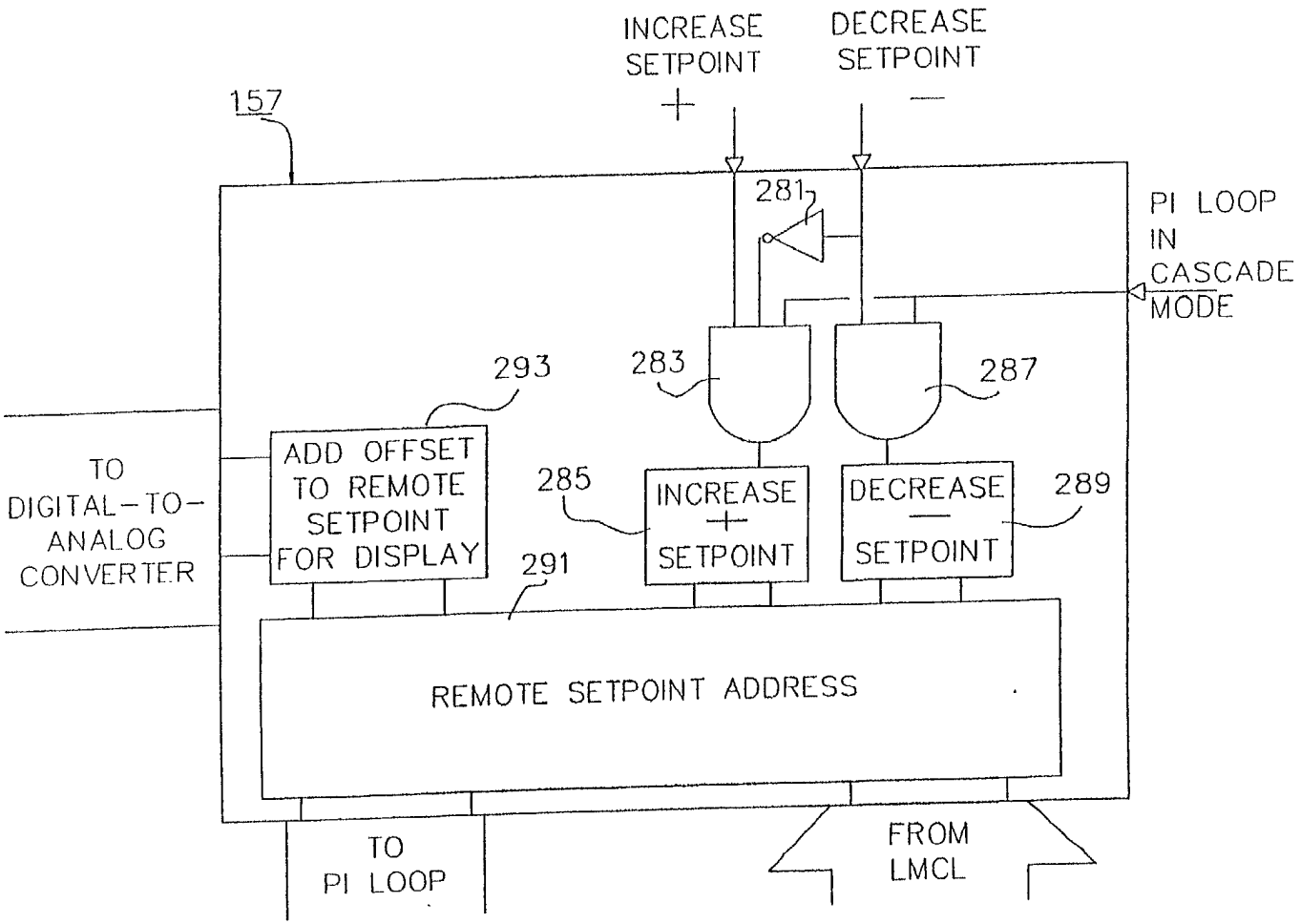

INCREASE SETPOINT
+
DECREASE SETPOINT
—
157
281
PI LOOP IN CASCADE MODE
293
283
287
TO DIGITAL-TO-ANALOG CONVERTER
ADD OFFSET TO REMOTE SETPOINT FOR DISPLAY
285
INCREASE + SETPOINT
DECREASE — SETPOINT
289
291
REMOTE SETPOINT ADDRESS
TO PI LOOP
FROM LMCL

FIGURE 12

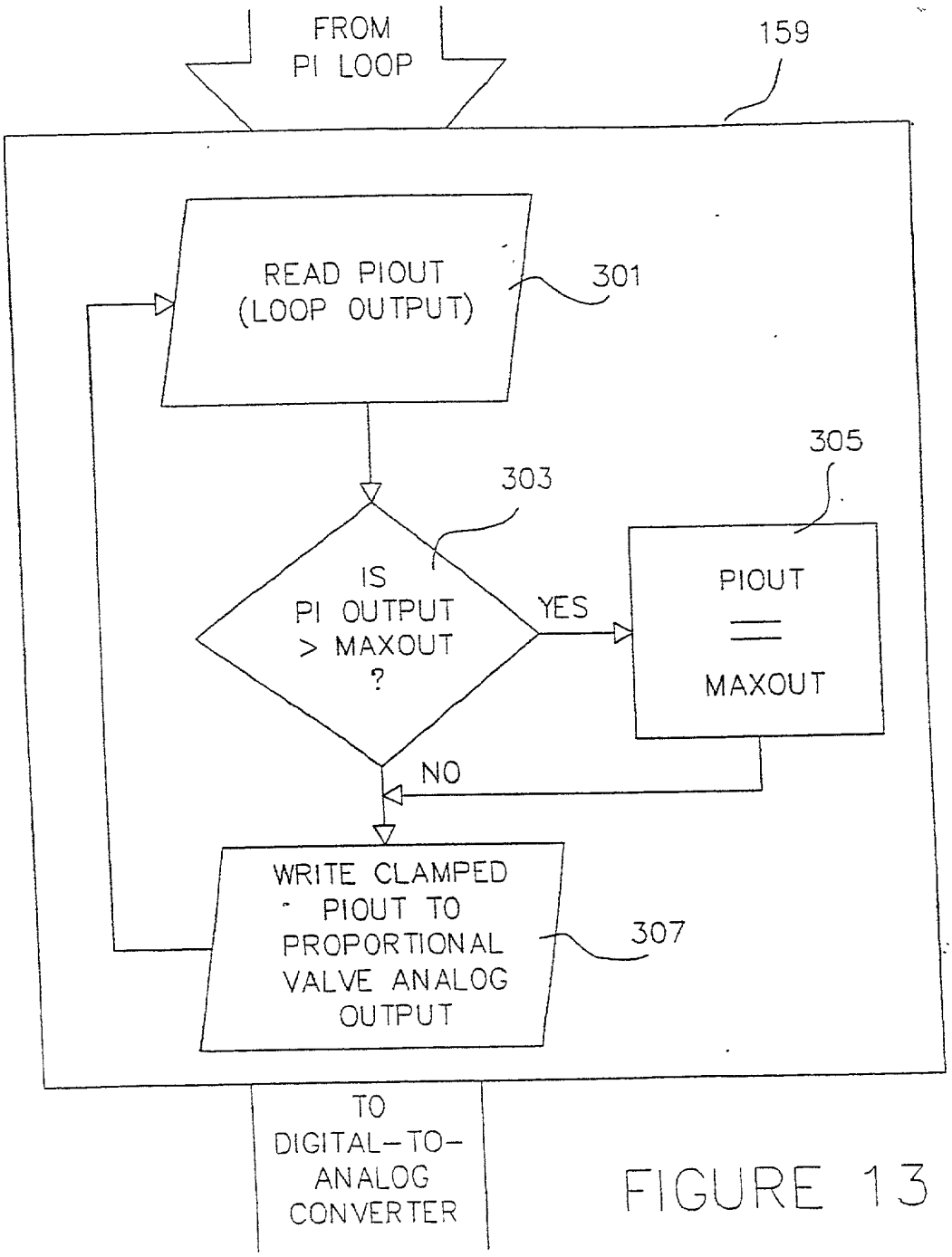

FROM
PI LOOP
159
READ PIOUT
(LOOP OUTPUT)
301
303
IS
PI OUTPUT
> MAXOUT
?
YES
305
PIOUT
=
MAXOUT
NO
WRITE CLAMPED
PIOUT TO
PROPORTIONAL
VALVE ANALOG
OUTPUT
307
TO
DIGITAL-TO-
ANALOG
CONVERTER

FIGURE 13

D5252064 "04-09-93

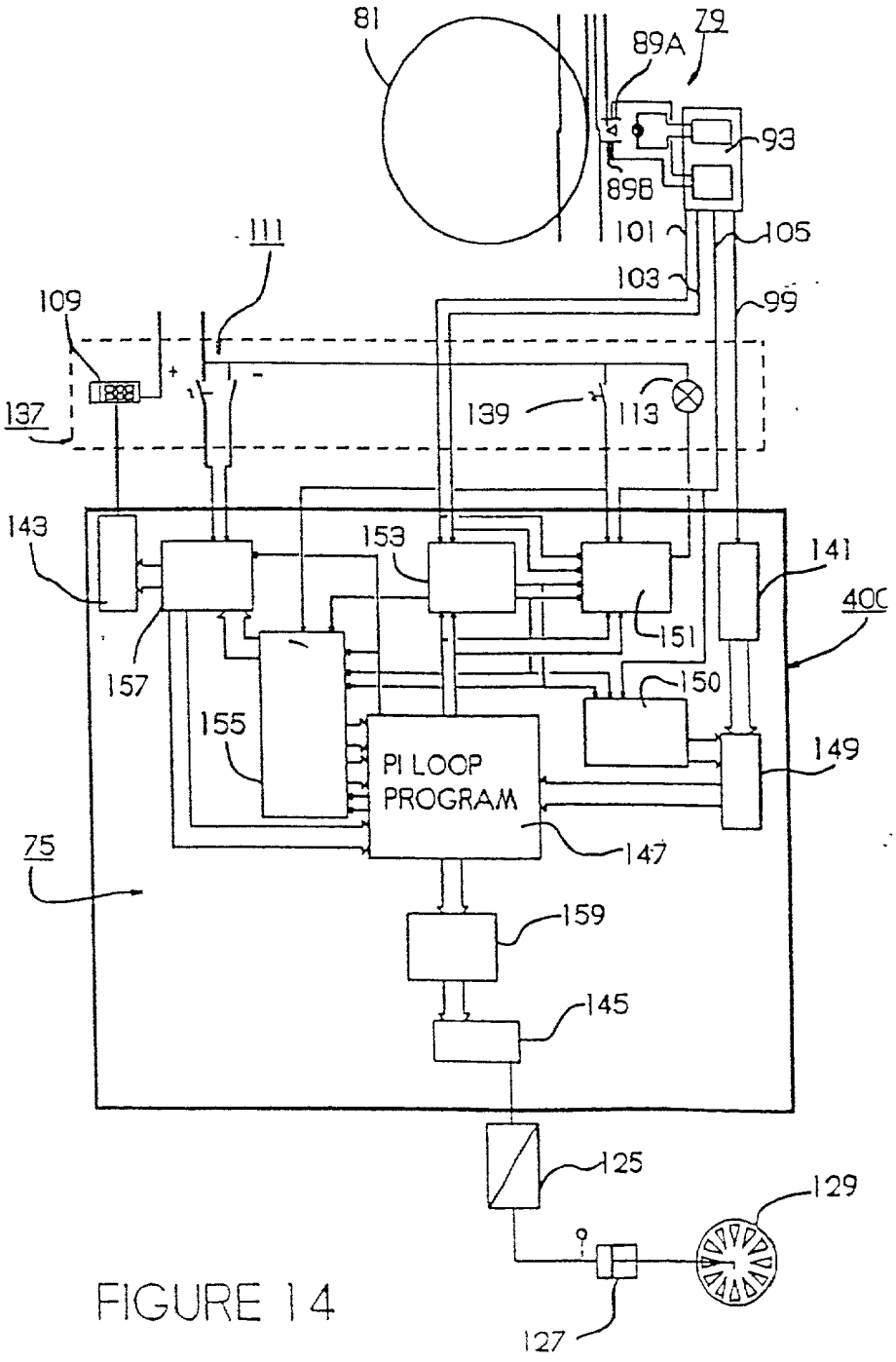


FIGURE 14

Tocrap "4805350

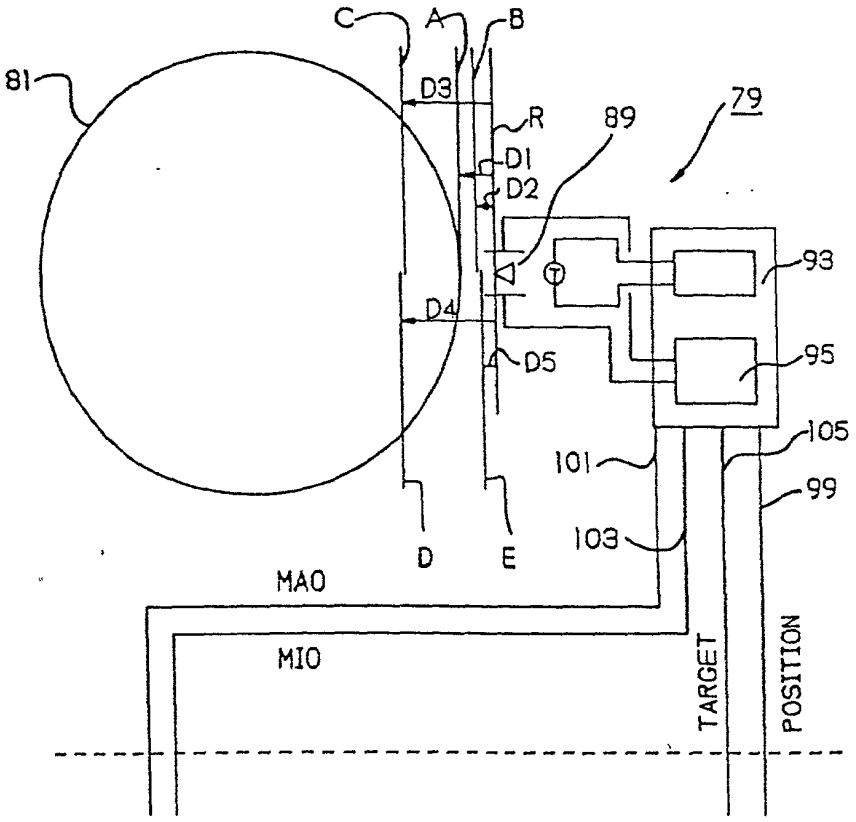


FIGURE 15

Document "GB2371491A" received 24.09.2002

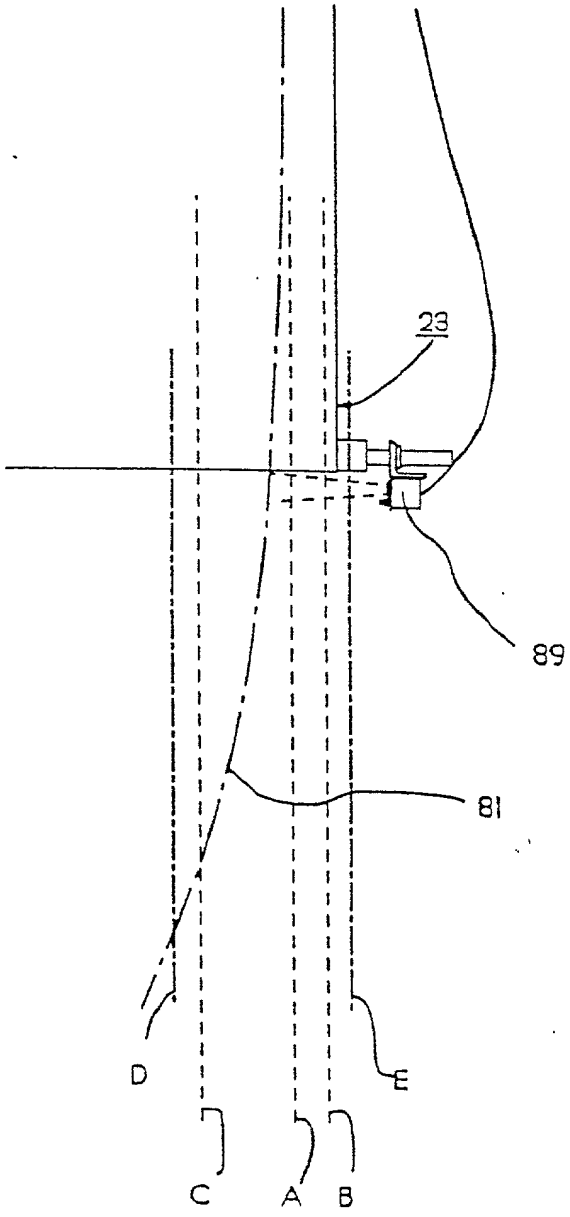


FIGURE 16

T09T80"t806286O

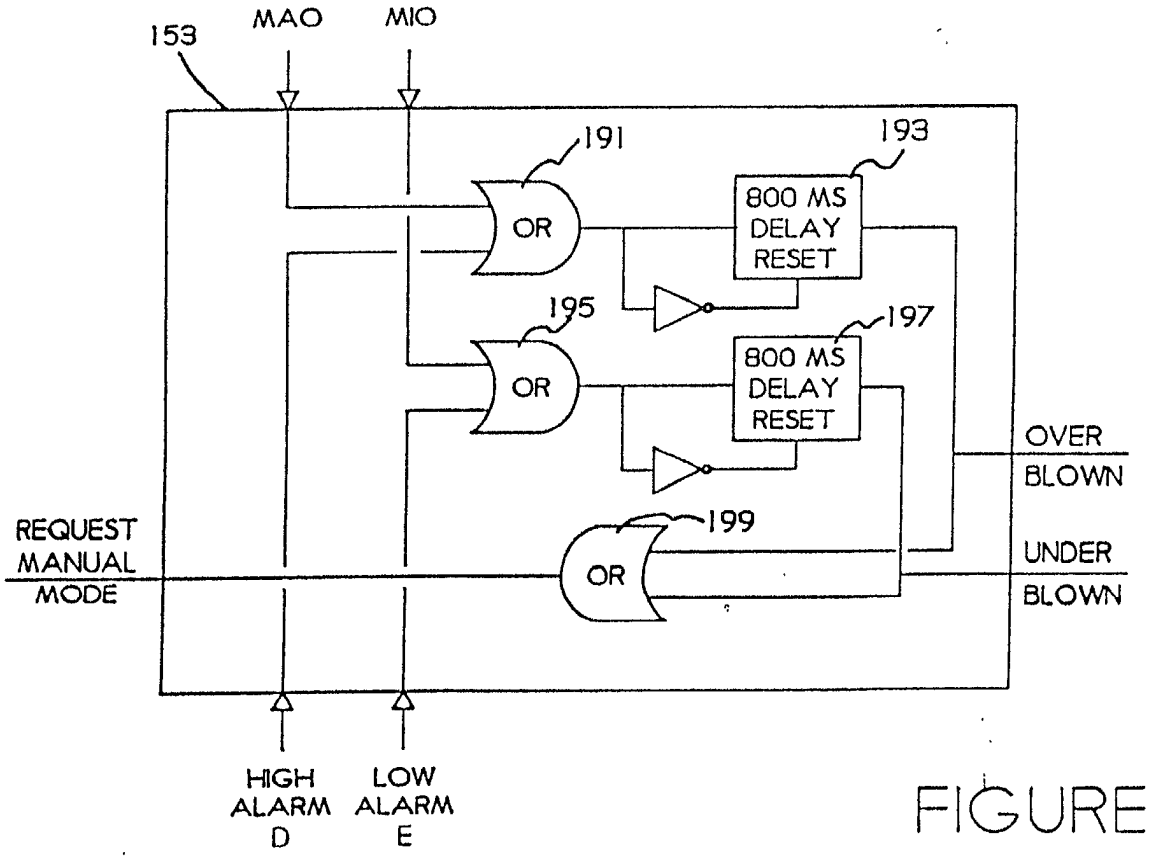


FIGURE 17

T09T80" h8062860

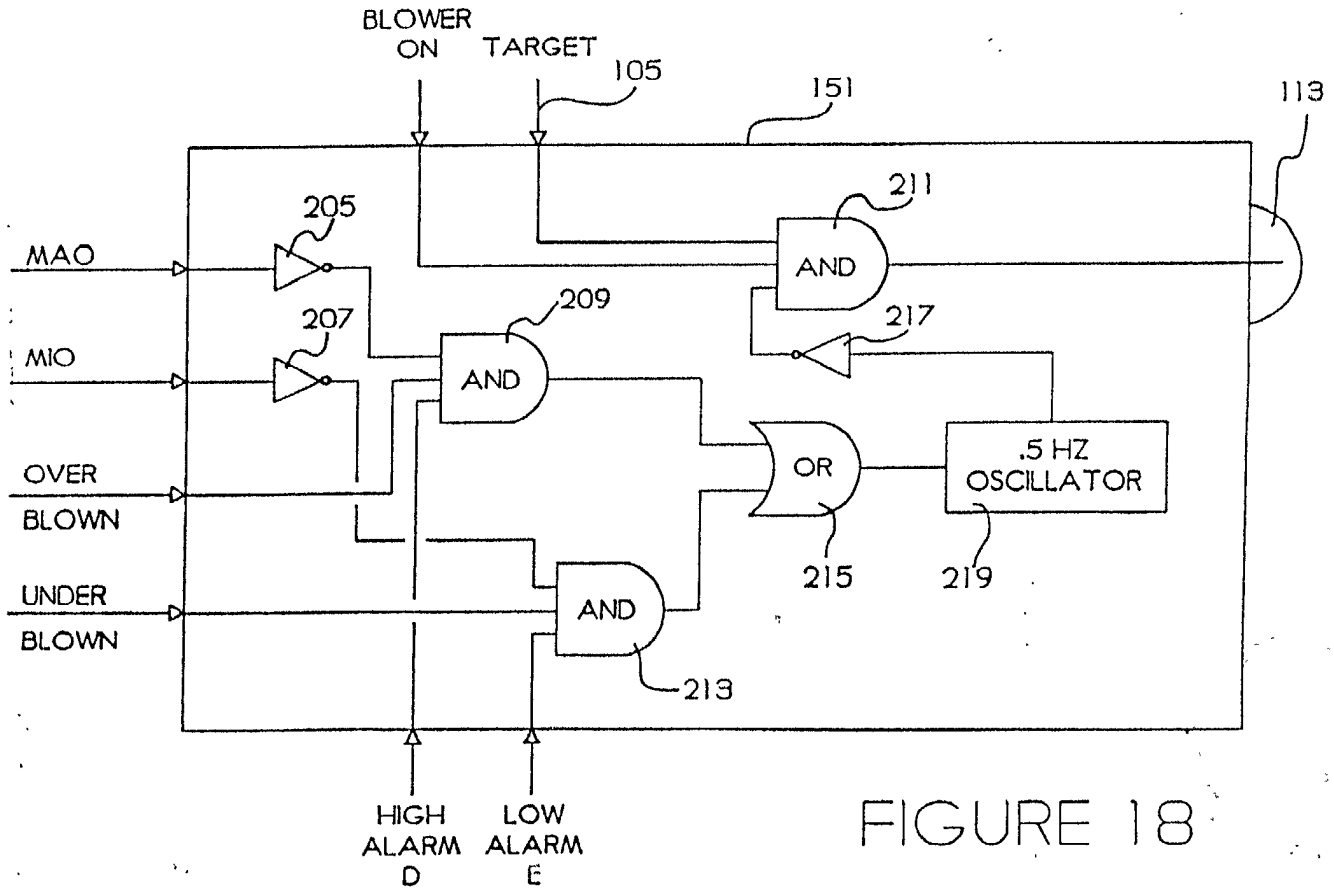
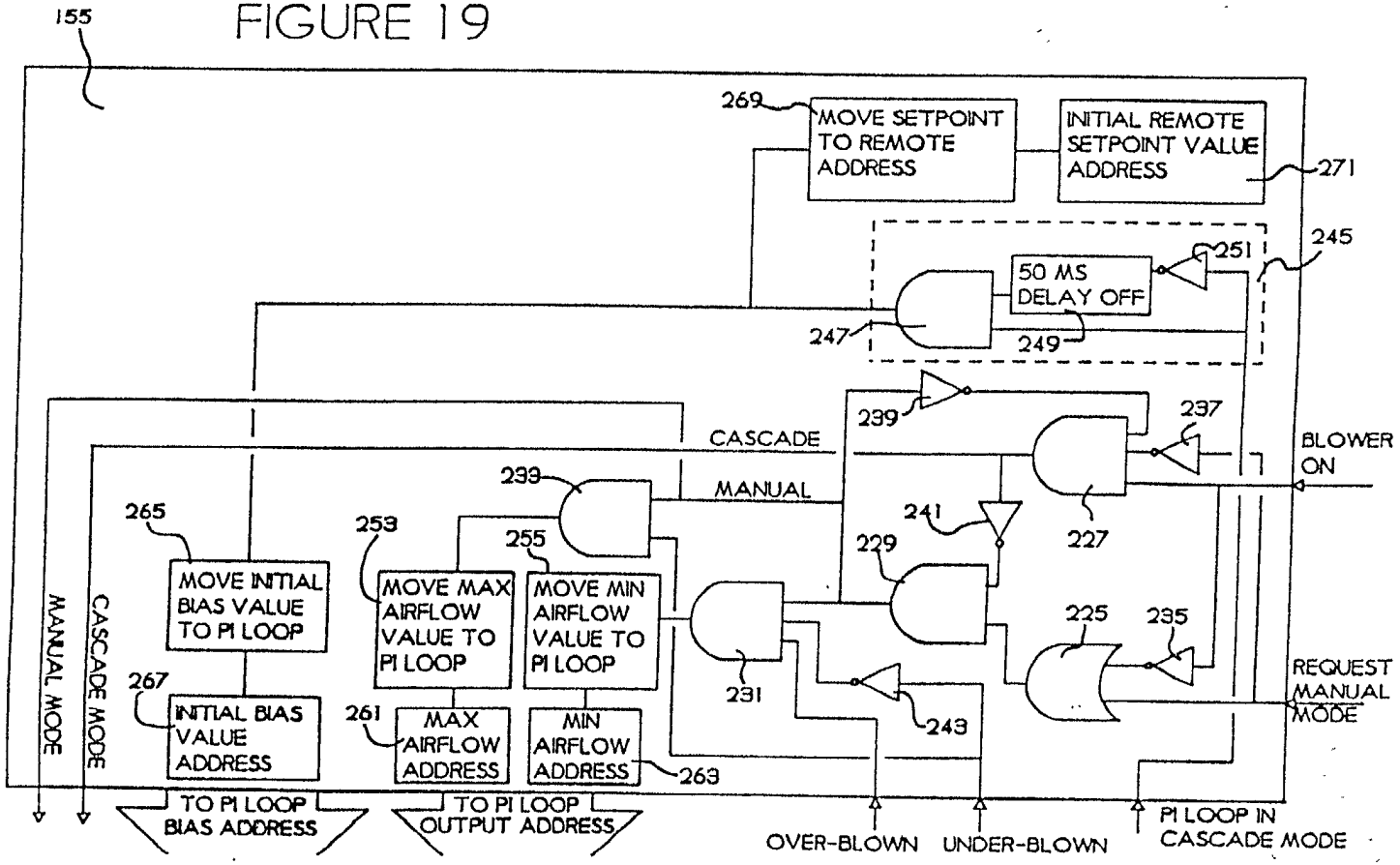


FIGURE 18

T09T80"tB062860

FIGURE 19



T09T80"+80628G0

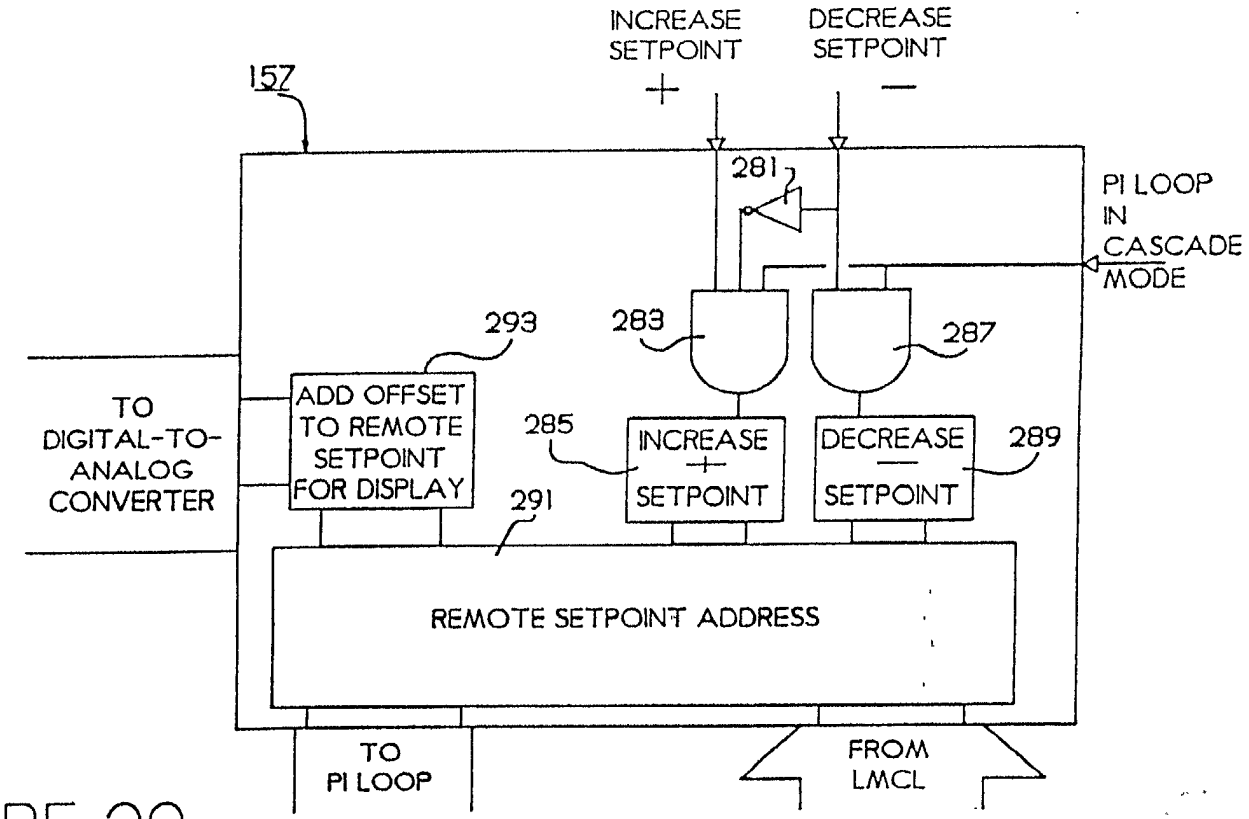
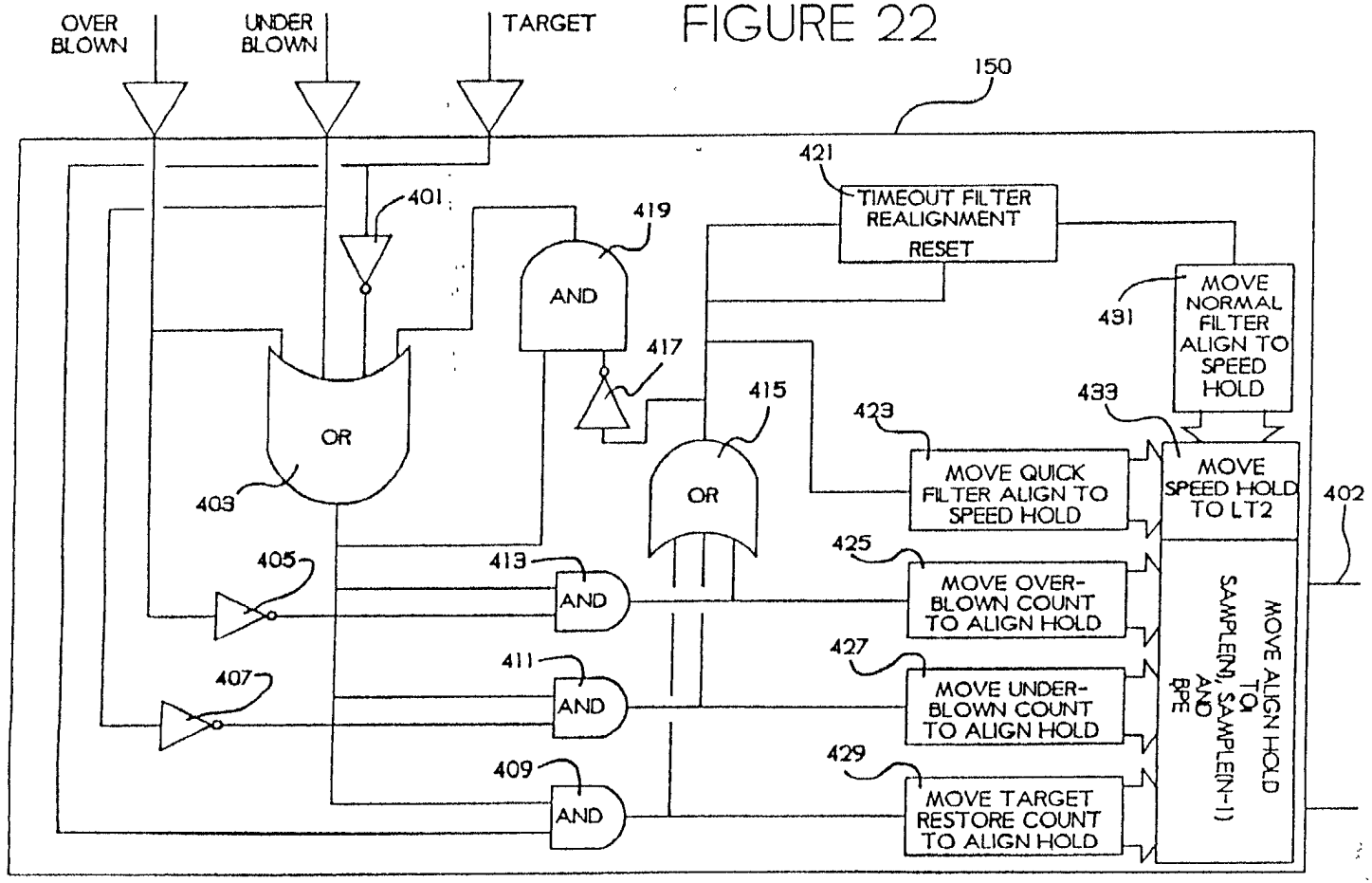


FIGURE 20

D-5694-4-5-5-5

FIGURE 22


OVER BLOWN
UNDER BLOWN
TARGET
150
421
TIMEOUT FILTER REALIGNMENT RESET
401
419
AND
431
MOVE NORMAL FILTER ALIGN TO SPEED HOLD
417
415
433
423
OR
OR
MOVE QUICK FILTER ALIGN TO SPEED HOLD
MOVE SPEED HOLD TO LT2
403
402
405
413
AND
425
MOVE OVER-BLOWN COUNT TO ALIGN HOLD
407
411
AND
427
MOVE UNDER-BLOWN COUNT TO ALIGN HOLD
409
AND
429
MOVE TARGET RESTORE COUNT TO ALIGN HOLD
MOVE ALIGN HOLD TO SAMPLE(N), SAMPLE(N-1) AND BPE

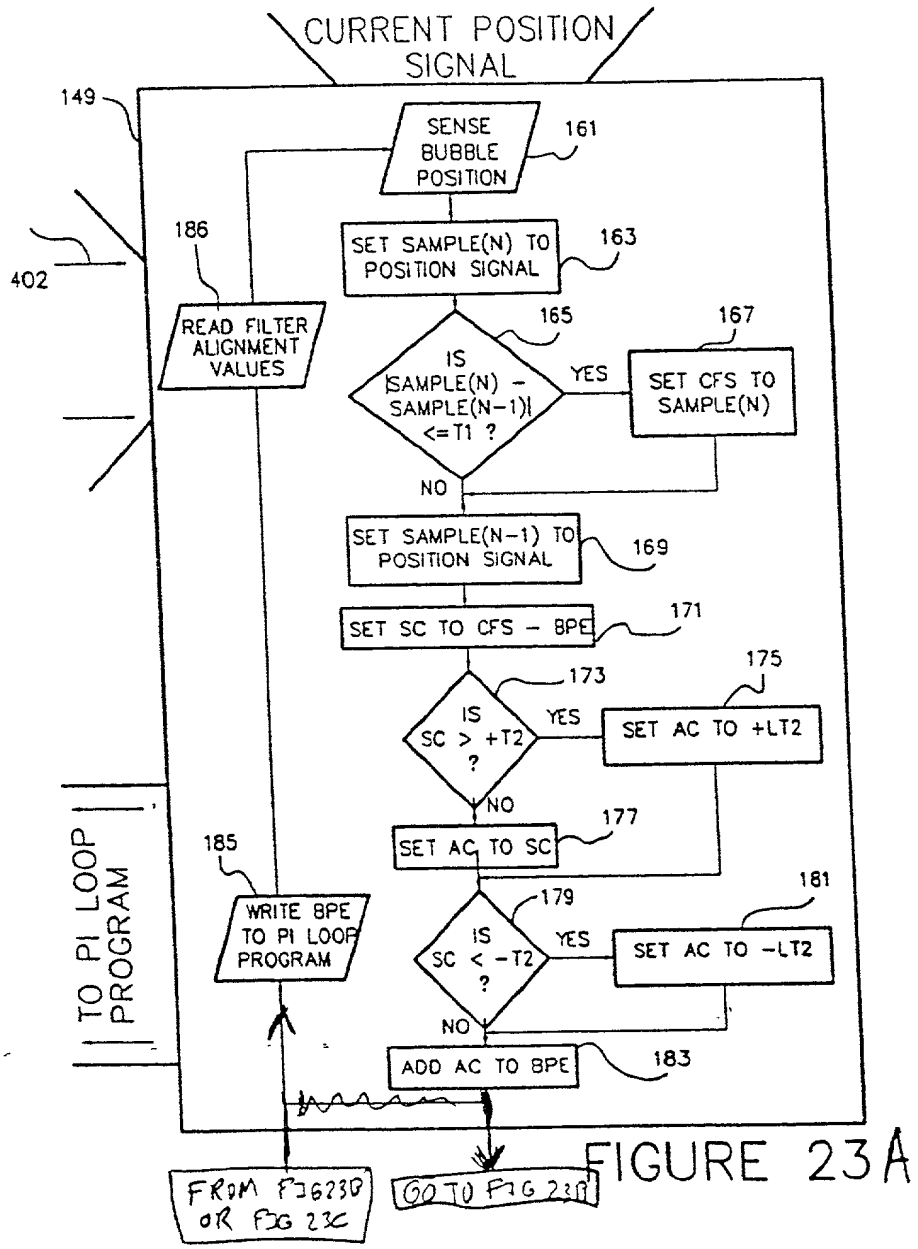

CURRENT POSITION SIGNAL
149
SENSE BUBBLE POSITION
161
186
SET SAMPLE(N) TO POSITION SIGNAL
163
402
READ FILTER ALIGNMENT VALUES
165
IS |SAMPLE(N) - SAMPLE(N-1)| <=T1 ?
YES
167
SET CFS TO SAMPLE(N)
NO
SET SAMPLE(N-1) TO POSITION SIGNAL
169
SET SC TO CFS - BPE
171
173
IS SC > +T2 ?
YES
175
SET AC TO +LT2
NO
SET AC TO SC
177
185
WRITE BPE TO PI LOOP PROGRAM
179
IS SC < -T2 ?
YES
181
SET AC TO -LT2
NO
ADD AC TO BPE
183
TO PI LOOP PROGRAM
FROM FIG 23B OR FIG 23C
GO TO FIG 23B

FIGURE 23A

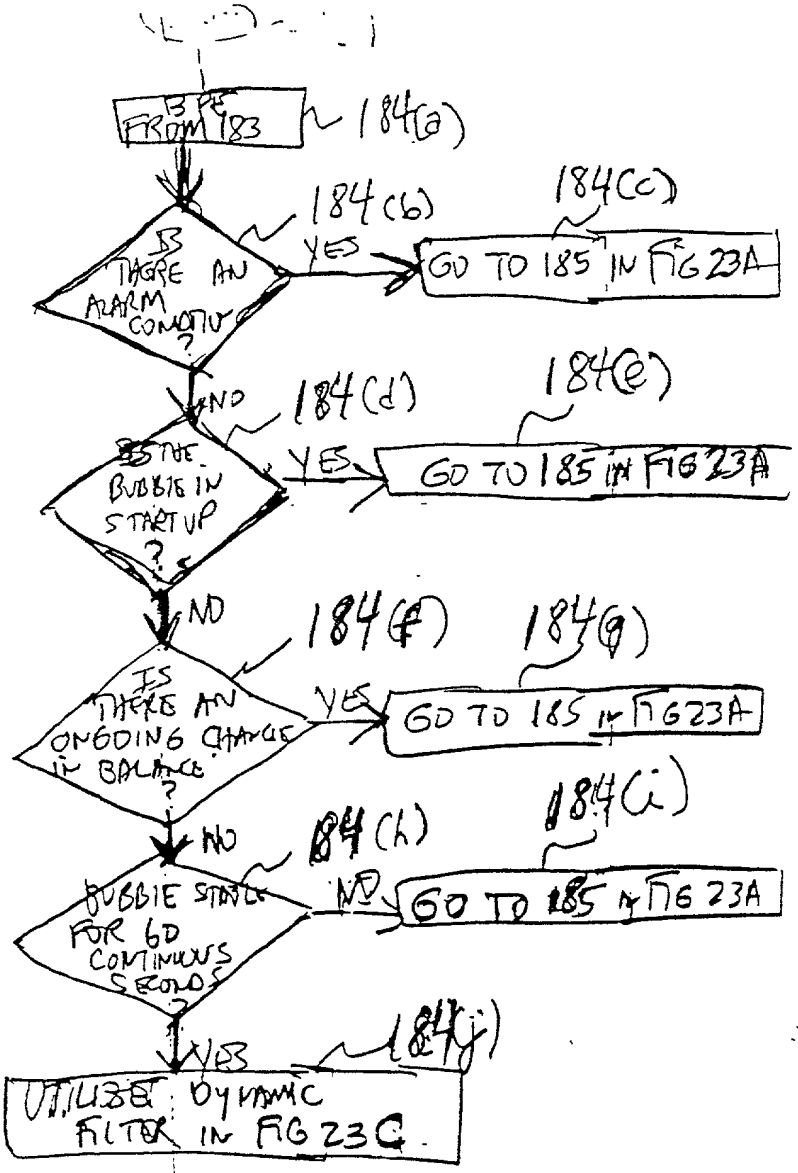

FROM 183
184(a)
IS THERE AN ALARM CONDITION ?
184(b)
YES
184(c)
GO TO 185 IN FIG 23A
NO
184(d)
IS THE BUBBLE IN START UP ?
YES
184(e)
GO TO 185 IN FIG 23A
NO
184(f)
IS THERE AN ONGOING CHANGE IN BALANCE ?
YES
184(g)
GO TO 185 IN FIG 23A
NO
184(h)
BUBBLE STABLE FOR 60 CONTINUOUS SECONDS ?
NO
184(i)
GO TO 185 IN FIG 23A
YES
184(j)
UTILIZE DYNAMIC FILTER IN FIG 23C

FIGURE 23B

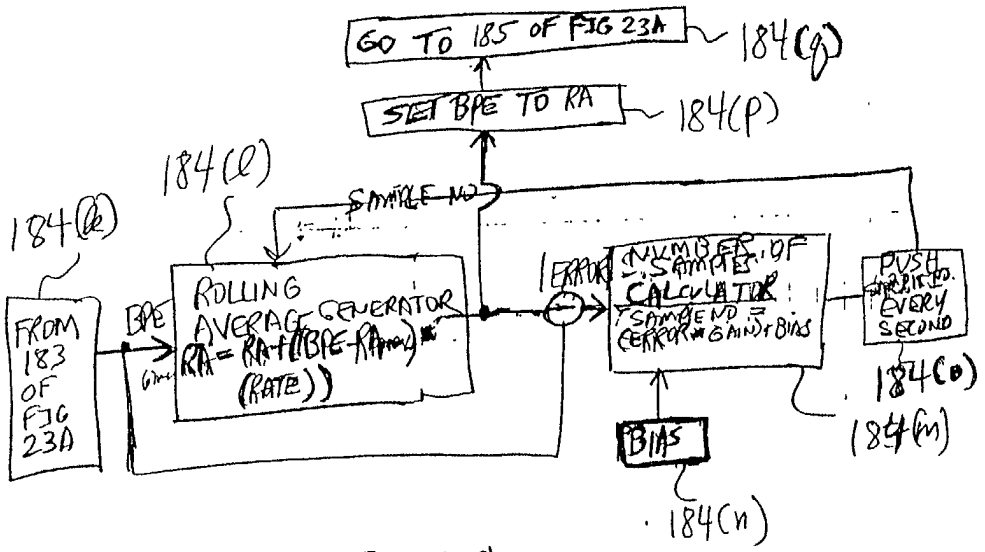

GO TO 185 OF FIG 23A
184(q)
SET BPE TO RA
184(p)
184(l)
SAMPLE NO
184(k)
FROM 183 OF FIG 23A
BPE
ROLLING AVERAGE GENERATOR
RA = RA + (BPE - RA) * (RATE))
ERROR
NUMBER OF SAMPLES CALCULATOR
SAMPLE NO = SAMPLE NO + GAIN * BIAS
PUSH BPE TO RA EVERY SECOND
184(o)
184(m)
BIAS
184(n)

FIG 23C

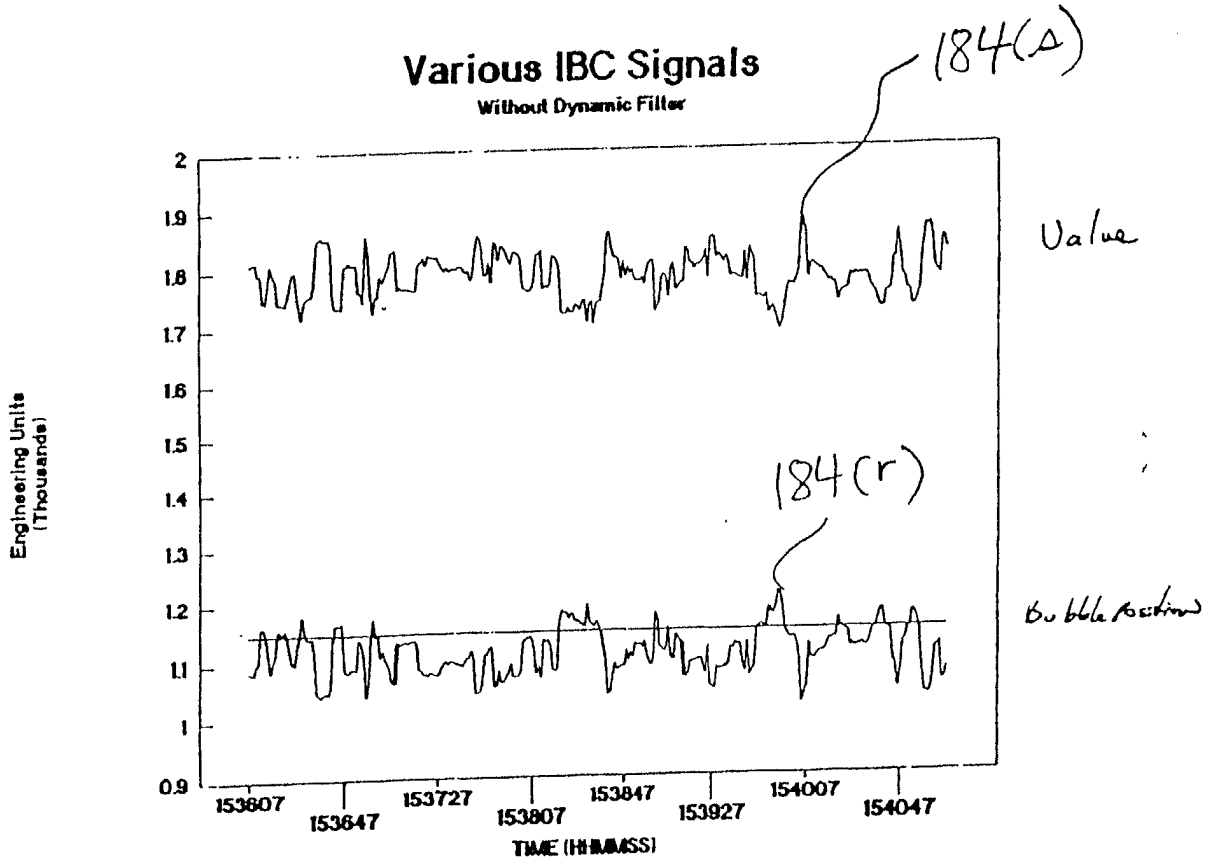

Various IBC Signals
Without Dynamic Filter
184(A)
Value
184(r)
Bubble Action
Engineering Units
(Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
153807
153647
153727
153807
153847
153927
154007
154047
TIME (HHMMSS)

Figure 23D

T09T80"h8062860

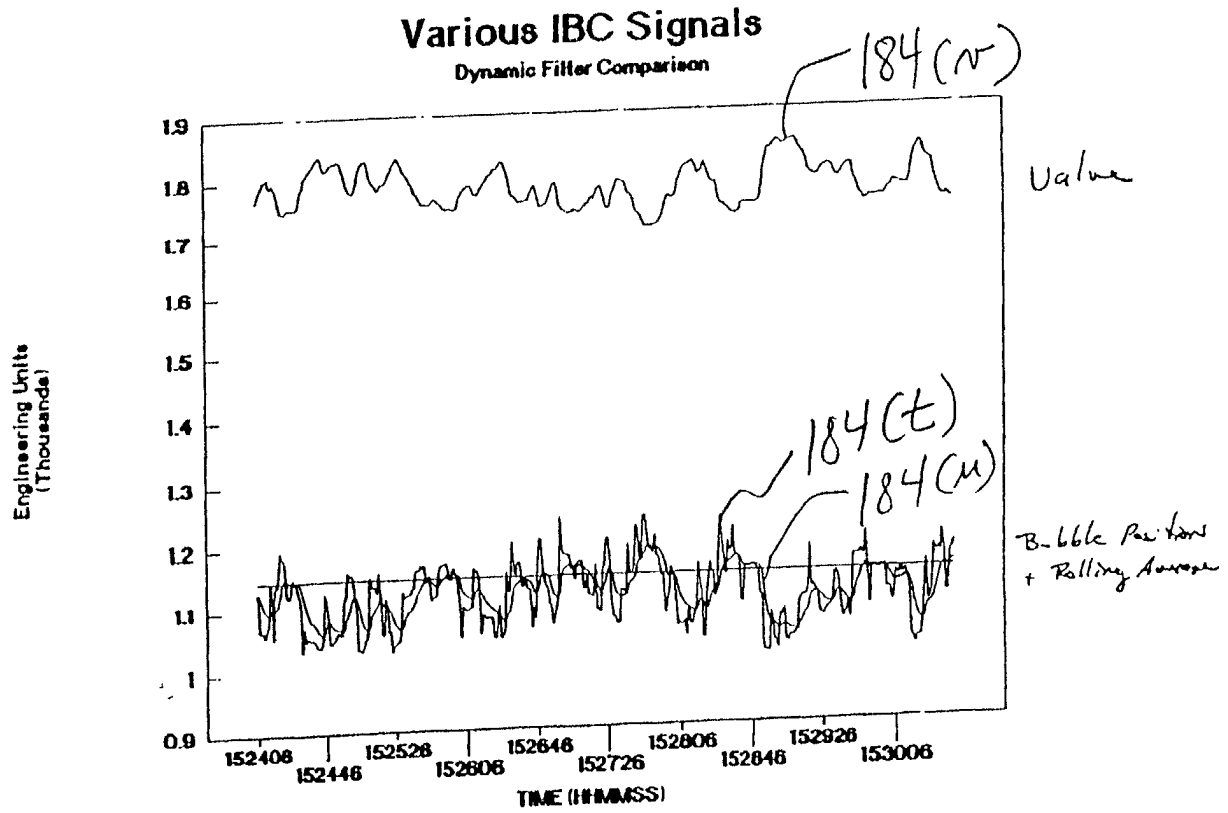


Figure 23E

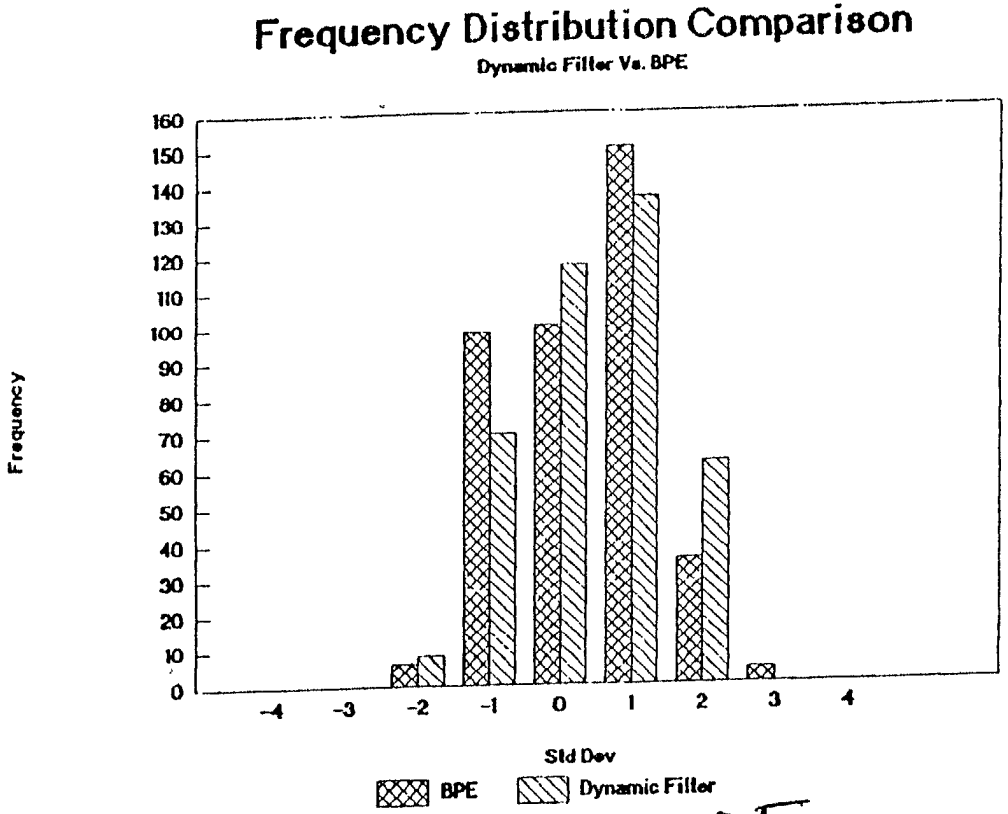

Frequency Distribution Comparison
Dynamic Filter Vs. BPE
Frequency
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-4
-3
-2
-1
0
1
2
3
4
Std Dev
BPE
Dynamic Filter

FIGURE 23F

T09T80" tB0628B60

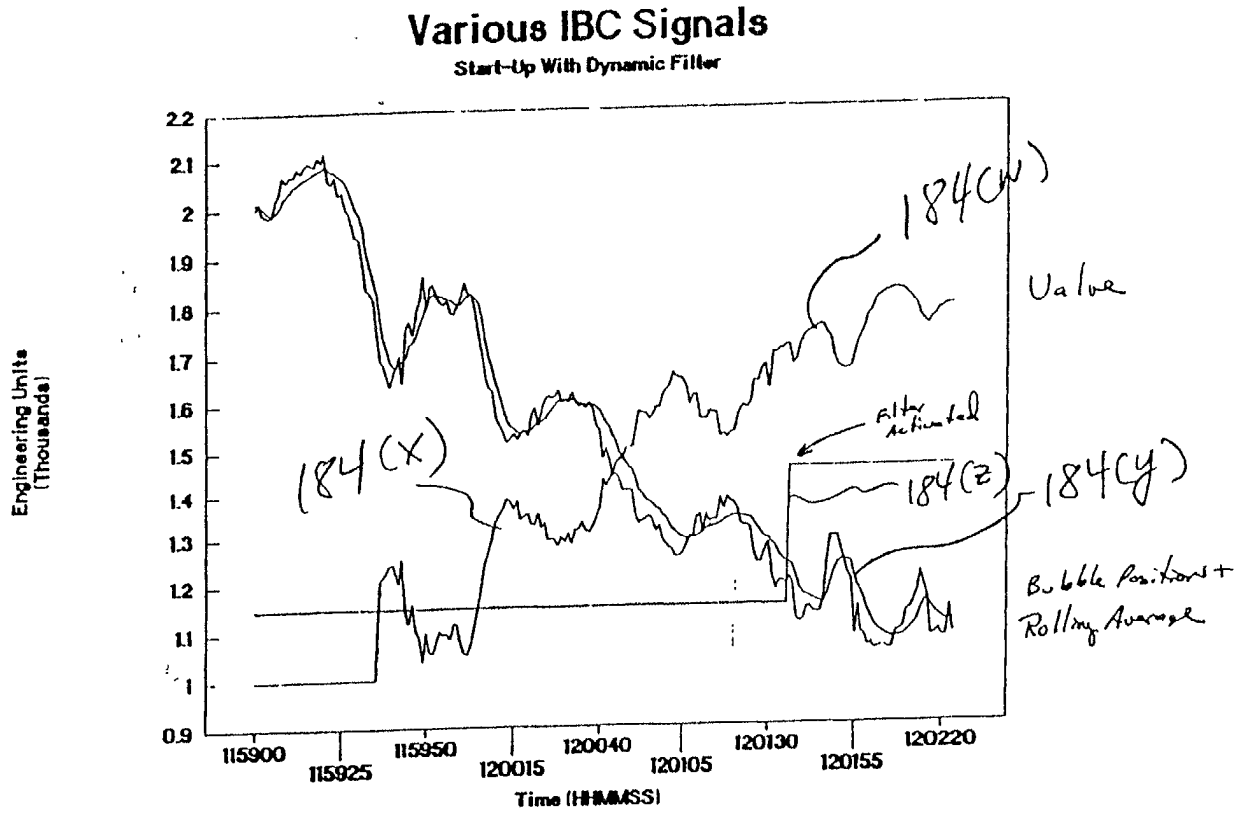


FIG 23G

T09T80"+80628860

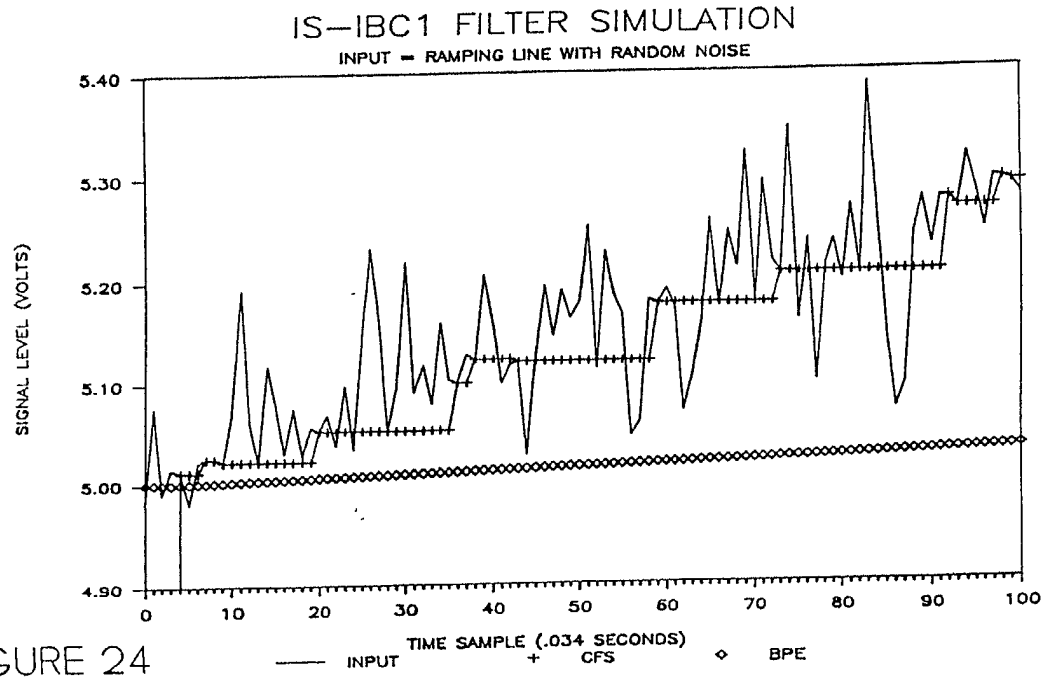
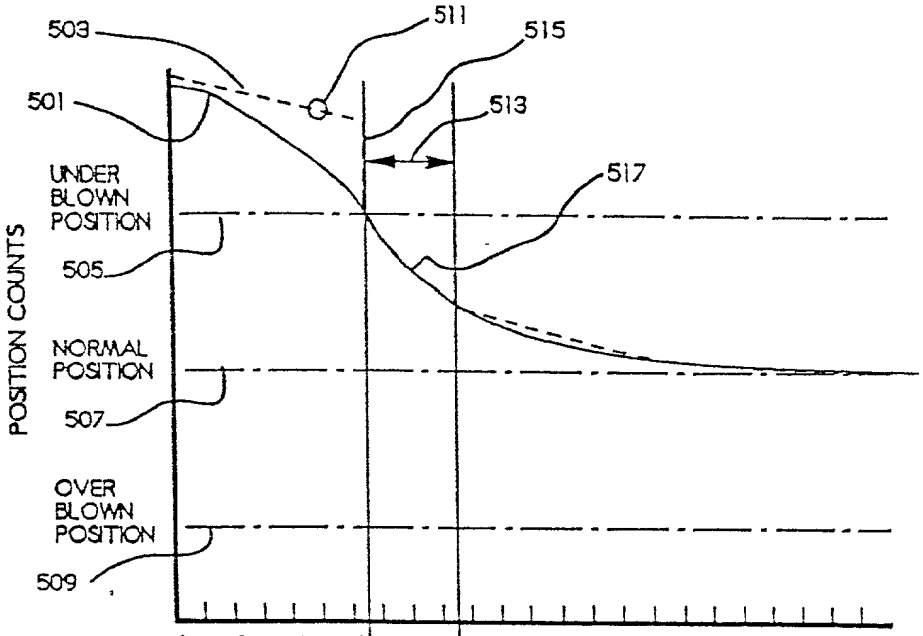


FIGURE 24

FIGURE 25A



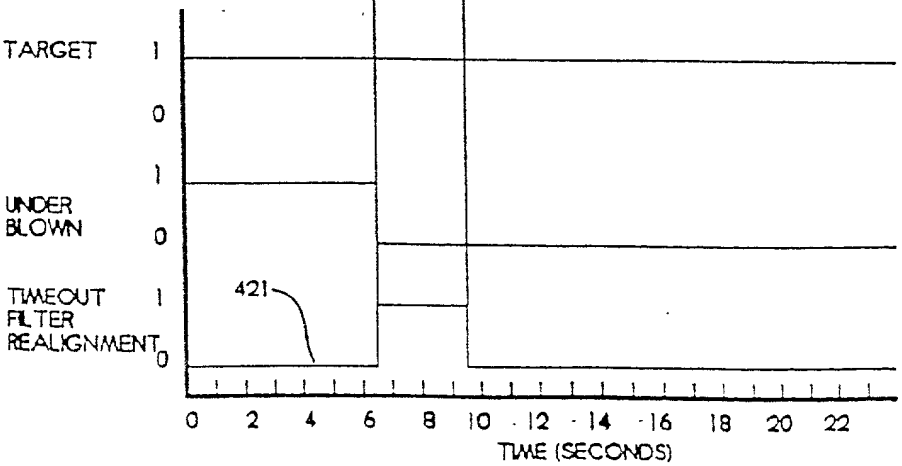
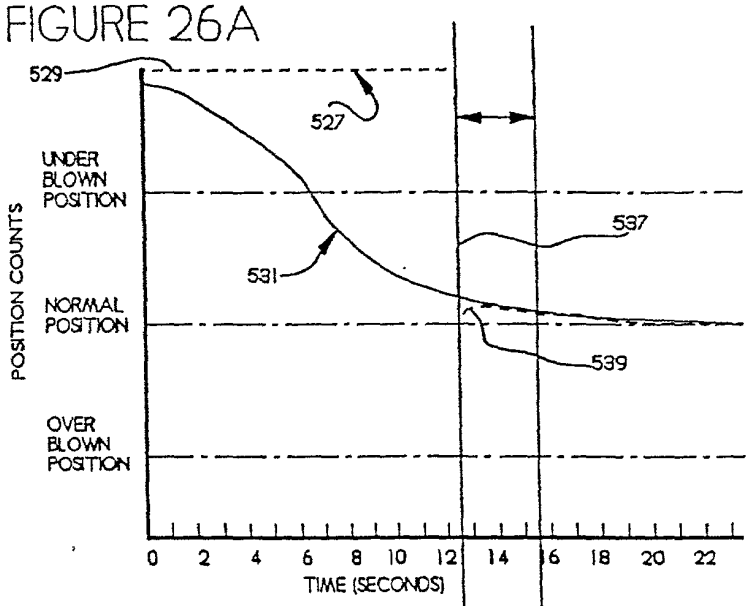


FIGURE 25B

09829084 - 061501

FIGURE 26A



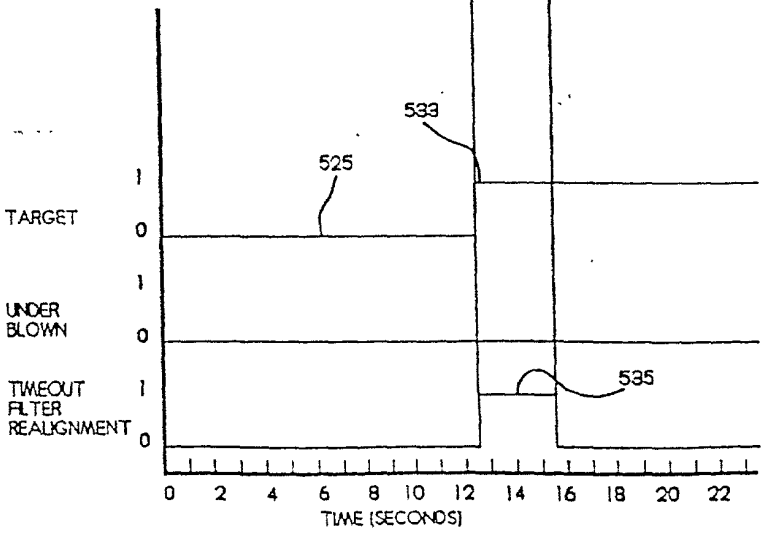


FIGURE 26B

FIGURE 27A

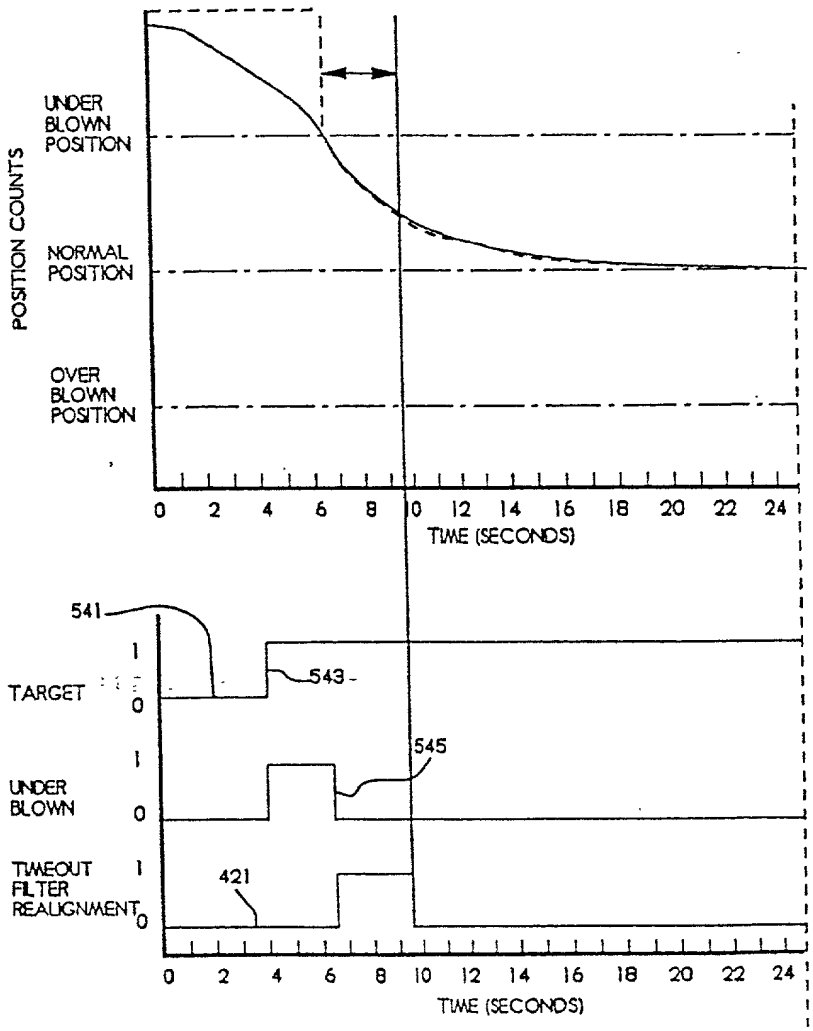


FIGURE 27B

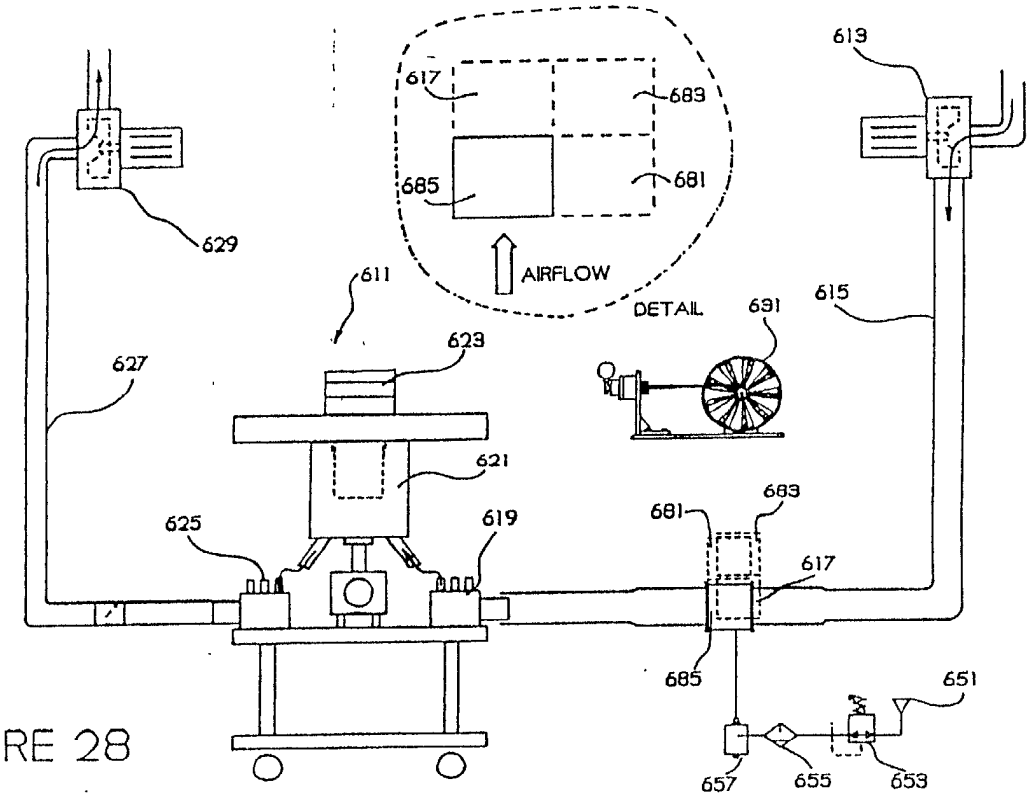

617
683
685
681
AIRFLOW
DETAIL
691
613
629
611
615
627
623
621
625
619
681
683
617
685
651
657
655
653

FIGURE 28

Printed: 4/8/2005

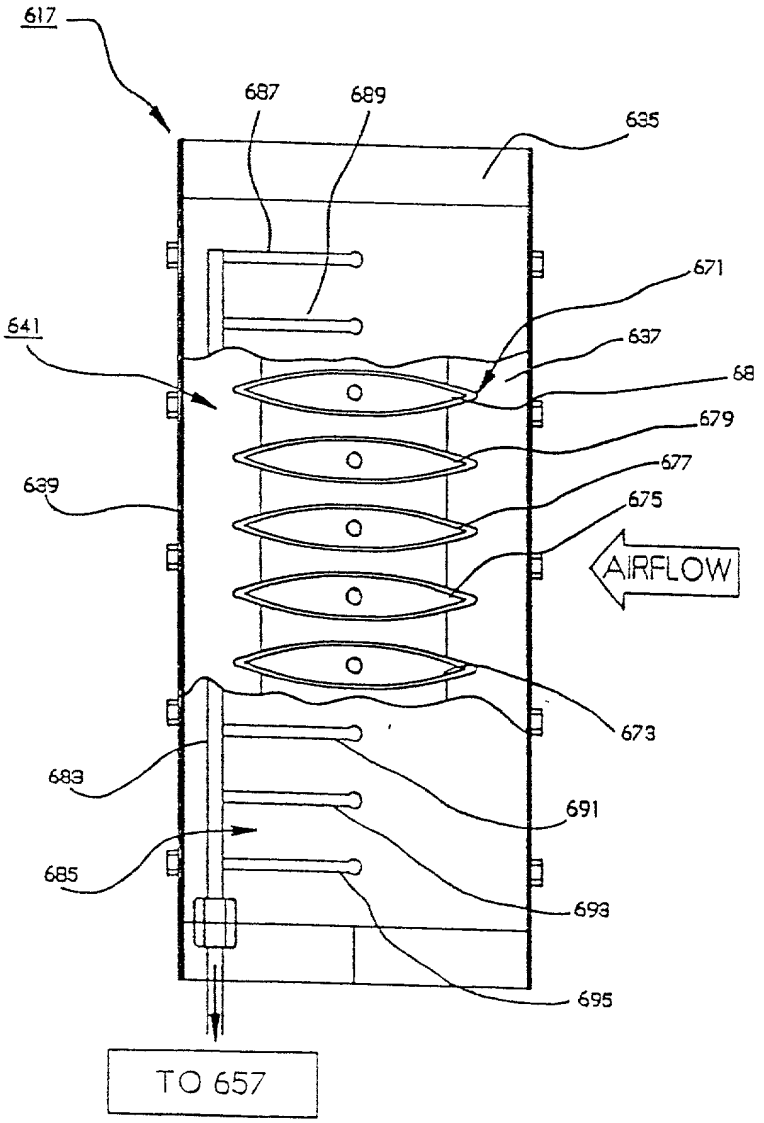


FIGURE 29

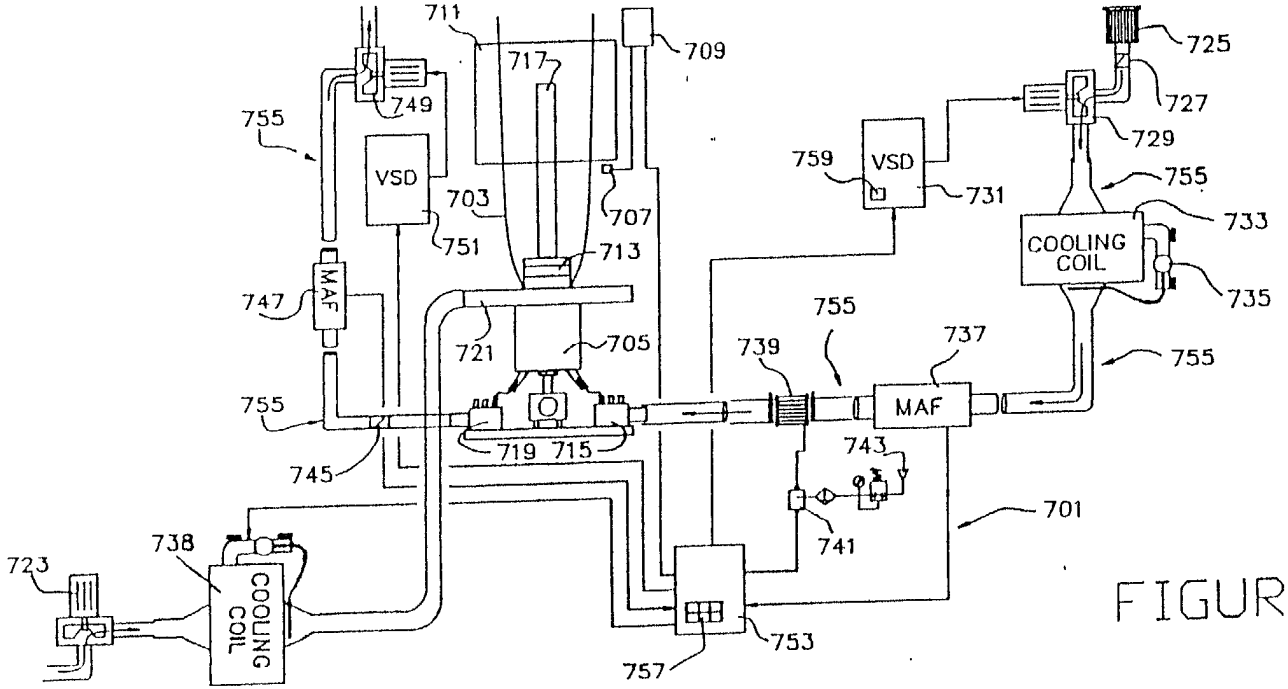

711
717
709
725
749
727
755
VSD
729
759
VSD
731
755
703
707
733
751
713
COOLING COIL
747
MAF
735
755
721
705
739
737
755
MAF
755
743
719
715
745
701
738
741
723
COOLING COIL
753
757

FIGURE 30

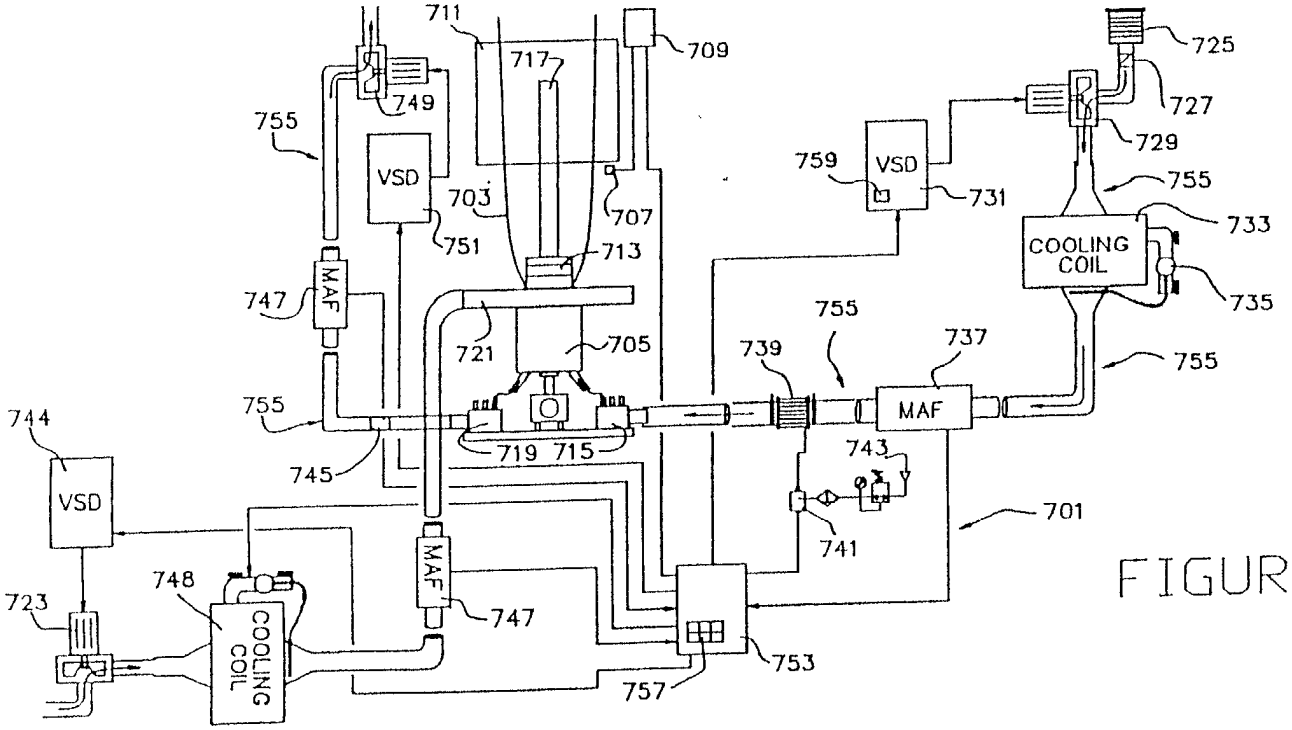

711
709
717
725
749
727
755
729
VSD
759
VSD
755
703
707
731
733
751
713
COOLING COIL
747
MAF
735
755
721
705
739
737
755
744
755
MAF
743
719
715
745
VSD
701
741
748
MAF
723
747
COOLING COIL
753
757

FIGURE 31

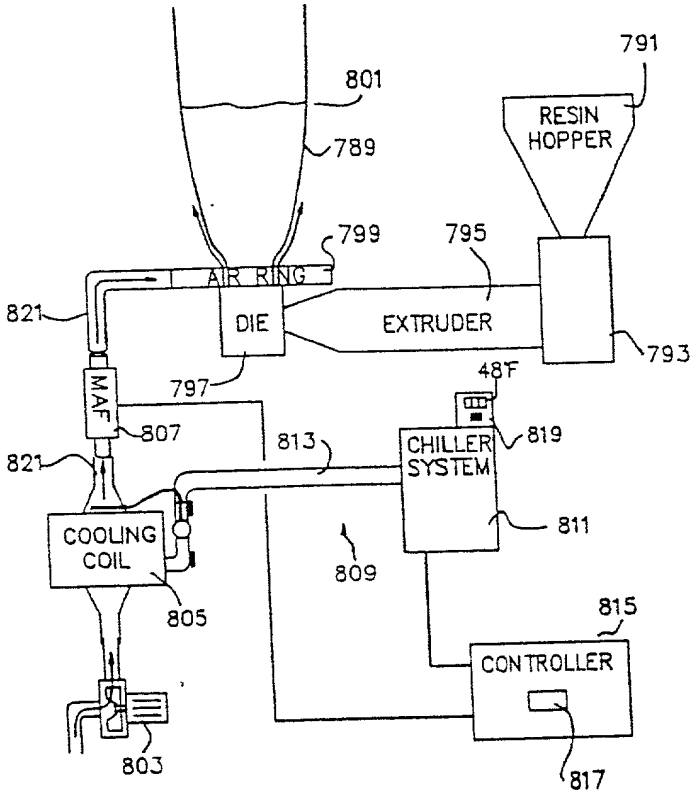

801
791
RESIN HOPPER
789
799
795
AIR RING
821
DIE
EXTRUDER
793
797
48F
MAF
807
813
CHILLER SYSTEM
819
821
811
COOLING COIL
809
805
815
CONTROLLER
803
817

FIGURE 32

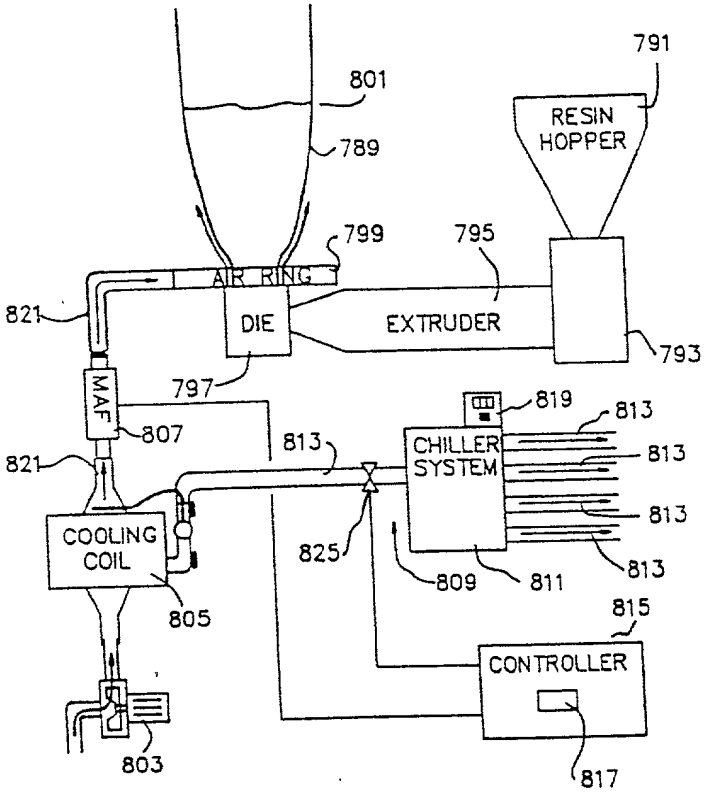

801
791
RESIN HOPPER
789
799
795
AIR RING
821
DIE
EXTRUDER
793
797
MAF
807
819
813
CHILLER SYSTEM
813
821
813
813
COOLING COIL
825
809
811
813
805
815
CONTROLLER
803
817

FIGURE 33

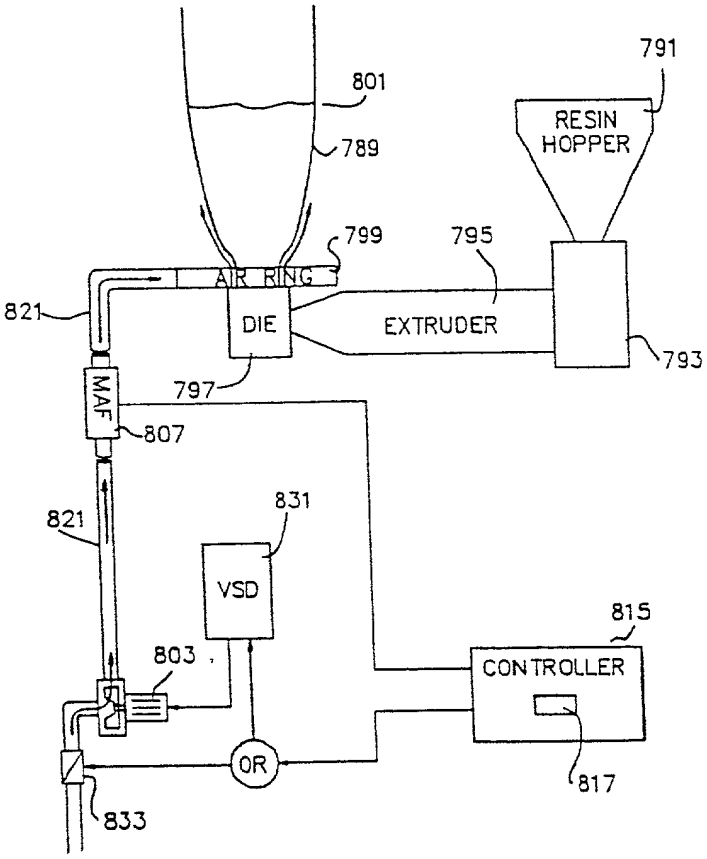

801
789
791
RESIN HOPPER
799
795
AIR RING
821
DIE
EXTRUDER
793
797
MAF
807
831
821
VSD
815
803
CONTROLLER
OR
817
833

FIGURE 34

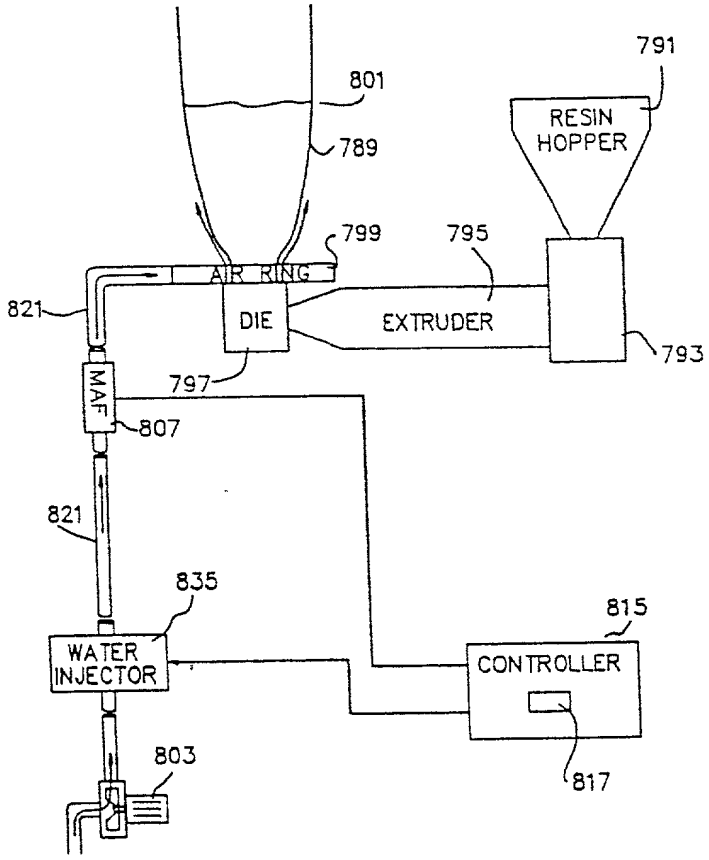

801
791
RESIN HOPPER
789
799
795
AIR RING
821
DIE
EXTRUDER
793
797
MAF
807
821
835
815
WATER INJECTOR
CONTROLLER
803
817

FIGURE 35

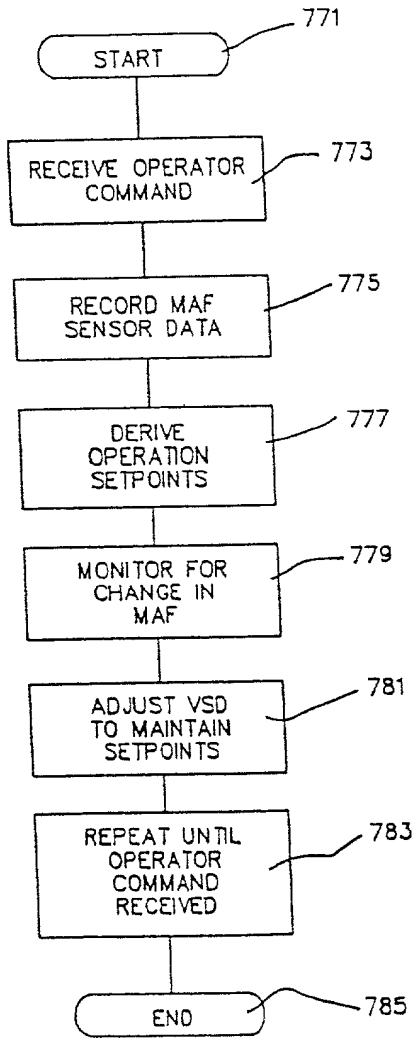

771
START
RECEIVE OPERATOR COMMAND
773
RECORD MAF SENSOR DATA
775
DERIVE OPERATION SETPOINTS
777
MONITOR FOR CHANGE IN MAF
779
ADJUST VSD TO MAINTAIN SETPOINTS
781
REPEAT UNTIL OPERATOR COMMAND RECEIVED
783
END
785

FIGURE 36

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

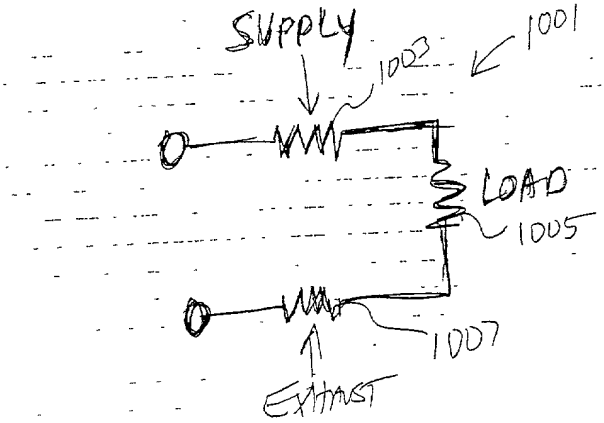


FIGURE 37A
(PRIOR ART)

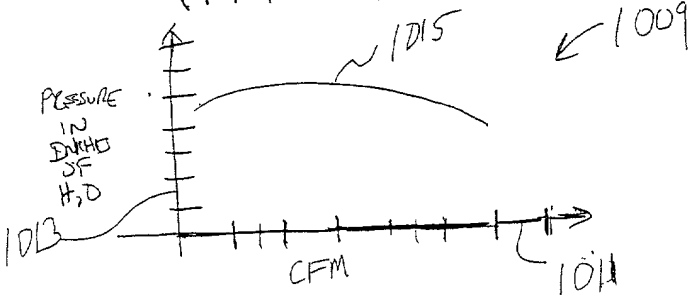


FIGURE 37B
(PRIOR ART)

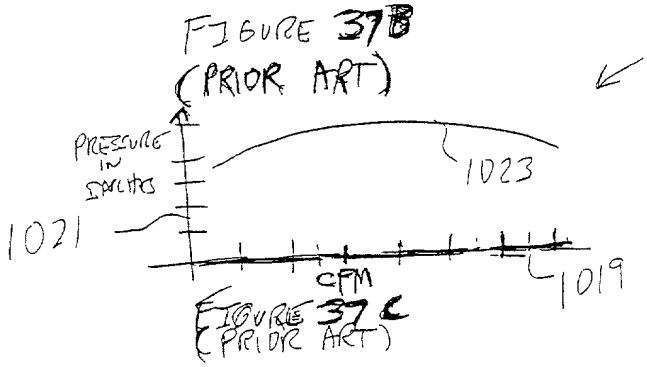


FIGURE 37C
(PRIOR ART)

US 6,868,854 B2

T09T80" tB062B60

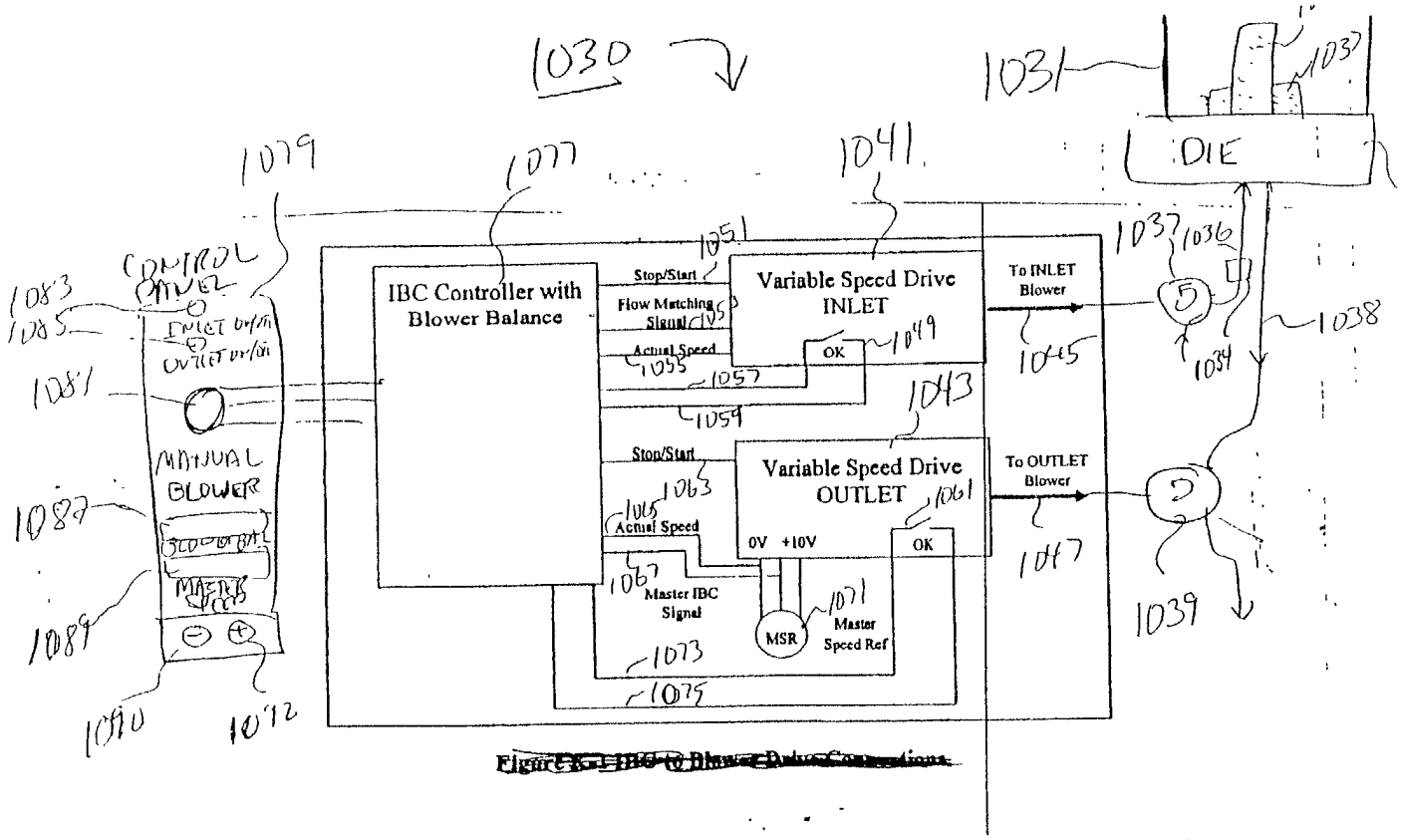


Figure 37 IBC to Blower Drive Connections

FIGURE 37D

Attorney _____

PATENT SKETCH FORM

ATTORNEYS

Client _____
File No. _____
Sheet No. _____ of _____

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

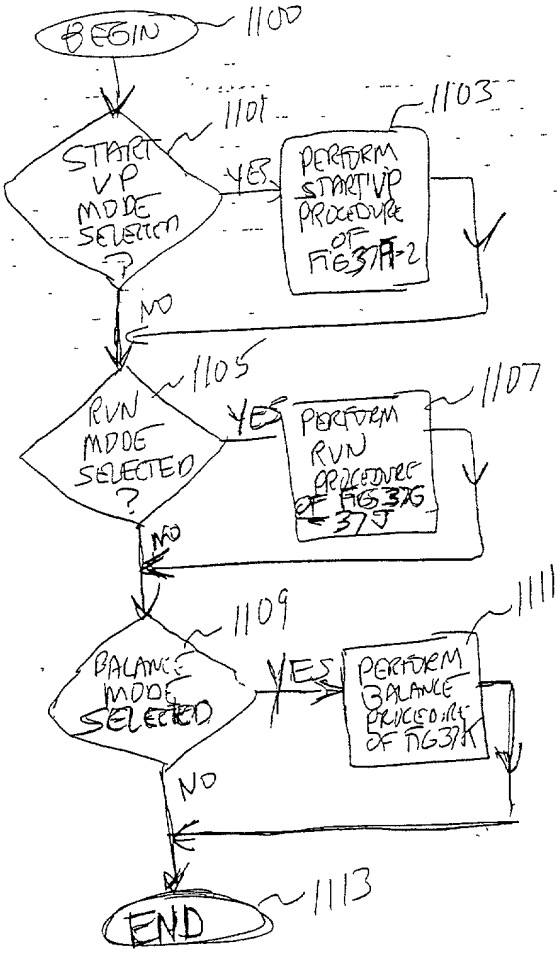


FIGURE 37E

Client: _____
File No.: _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

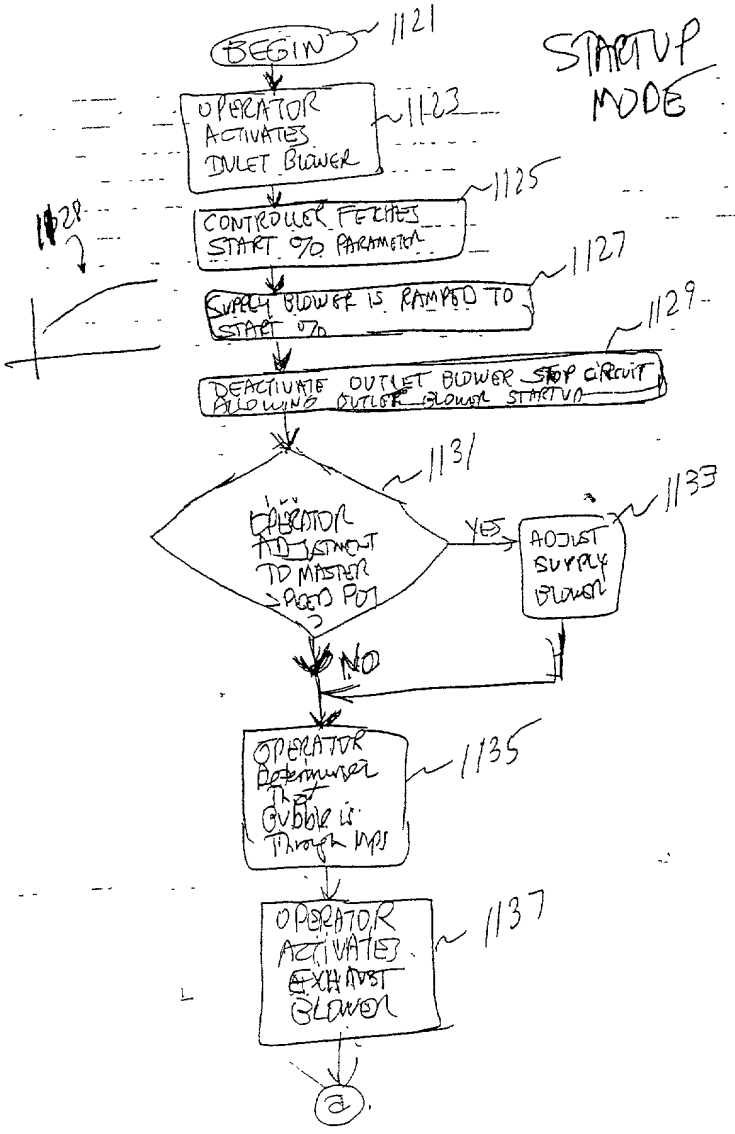


FIG 37 FI

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

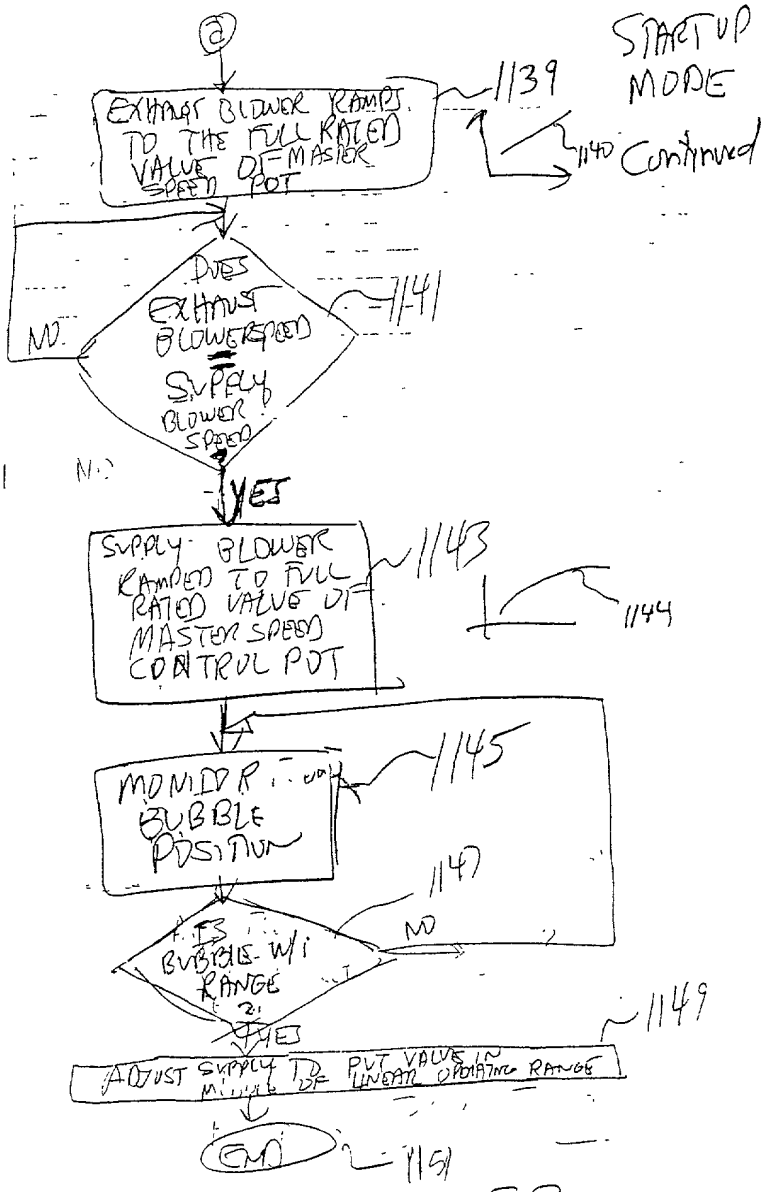


FIGURE 37 F2

FELSMAN, BRADLEY, GUNTER & DILLON
ATTORNEYS

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

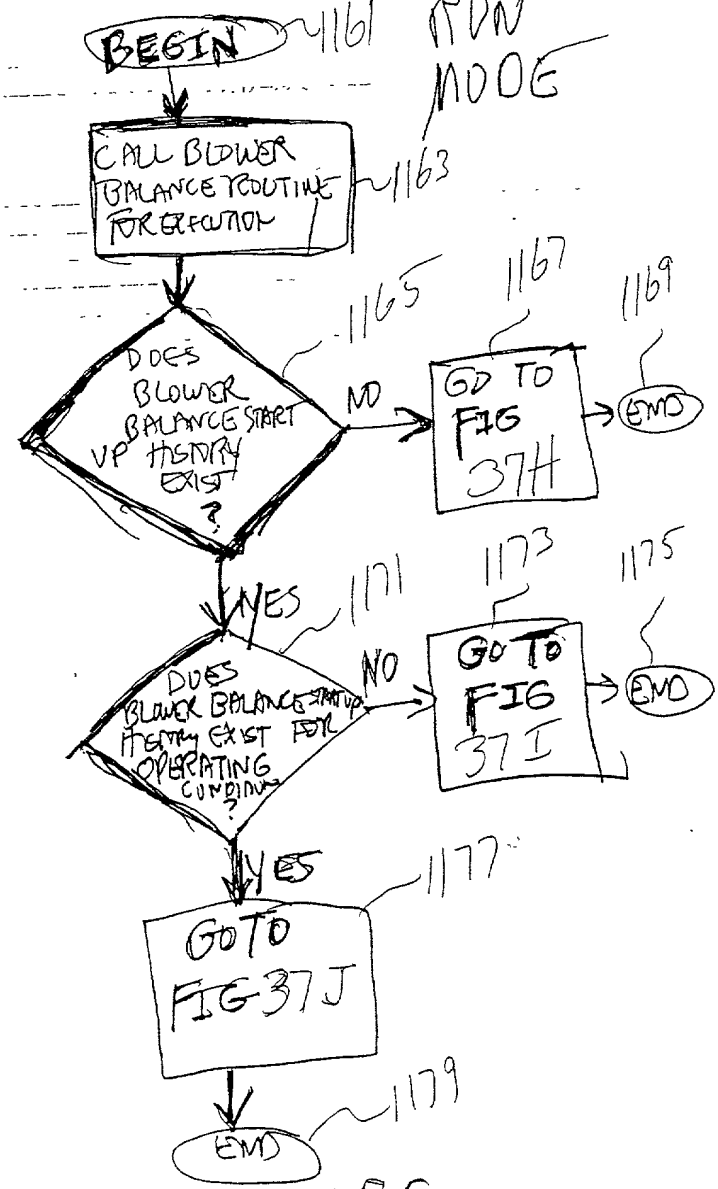


FIGURE 37G

ATTORNEYS

Client _____
File No _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

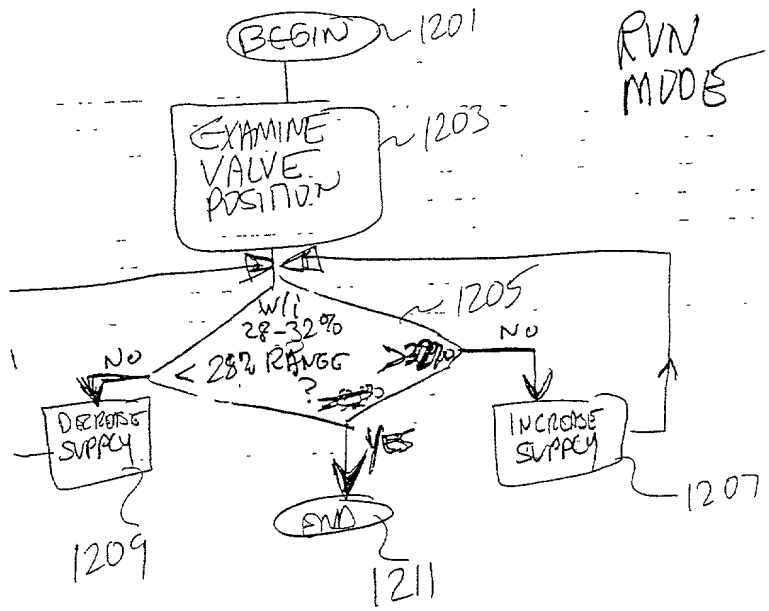


FIGURE 3TH

FELLMAN, BRADLEY, GUNTER & DILLON
ATTORNEYS

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

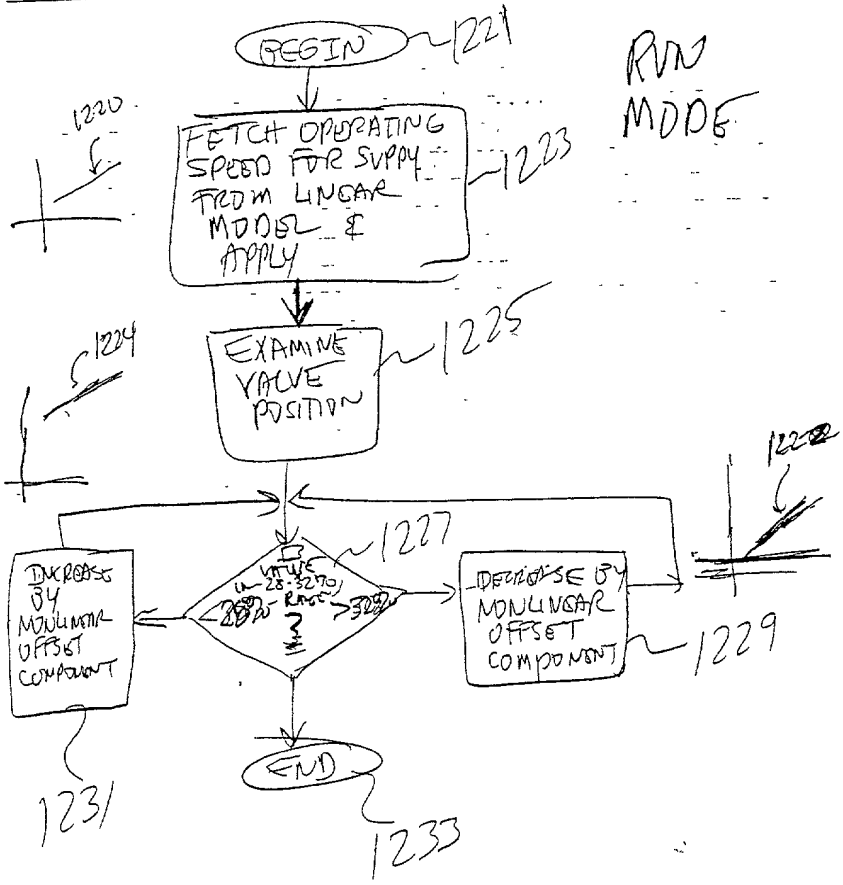


FIGURE 37I

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

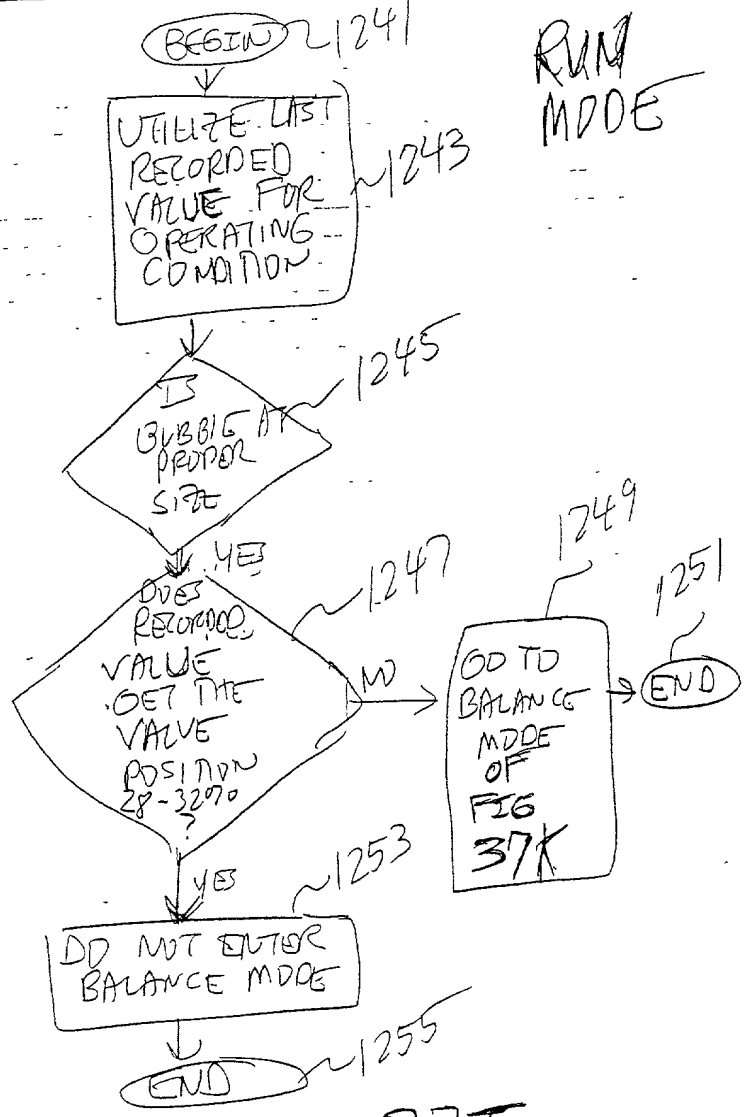


FIGURE 37J

FEL...IAN, BRADLEY, GUNTER & DILLO...
ATTORNEYS

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

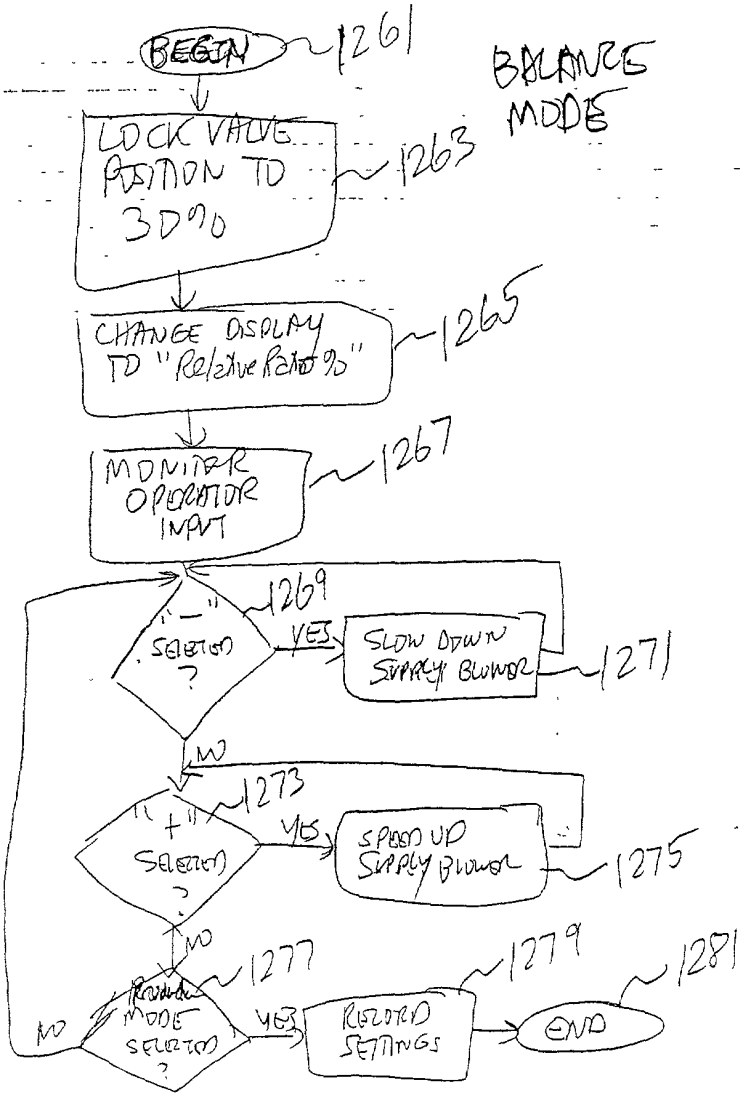


FIGURE 37K

95259034 "05161601

ATTORNEYS

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

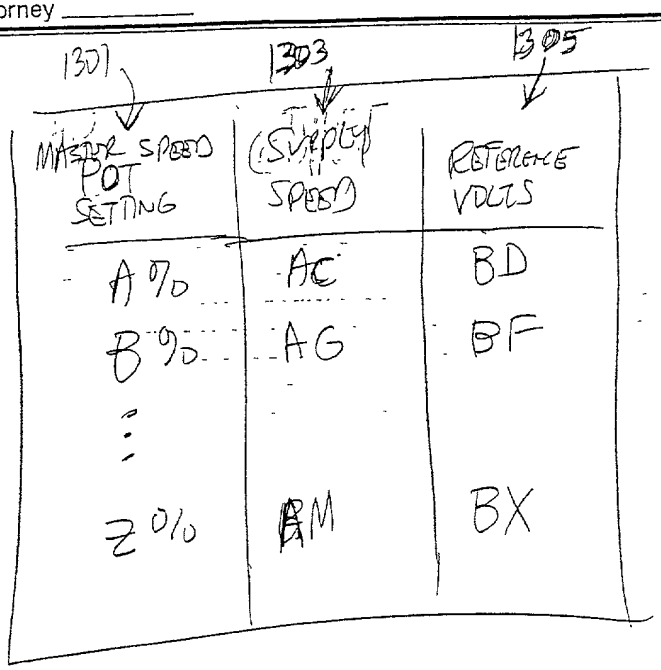


FIGURE 37L

Doc Code: AP.PRE.REQ

FELSMAN, BRADLEY, GUNTER & DILLON
ATTORNEYS

Client _____
File No. _____
Sheet No. ____ of ____

PATENT SKETCH FORM

Attorney _____

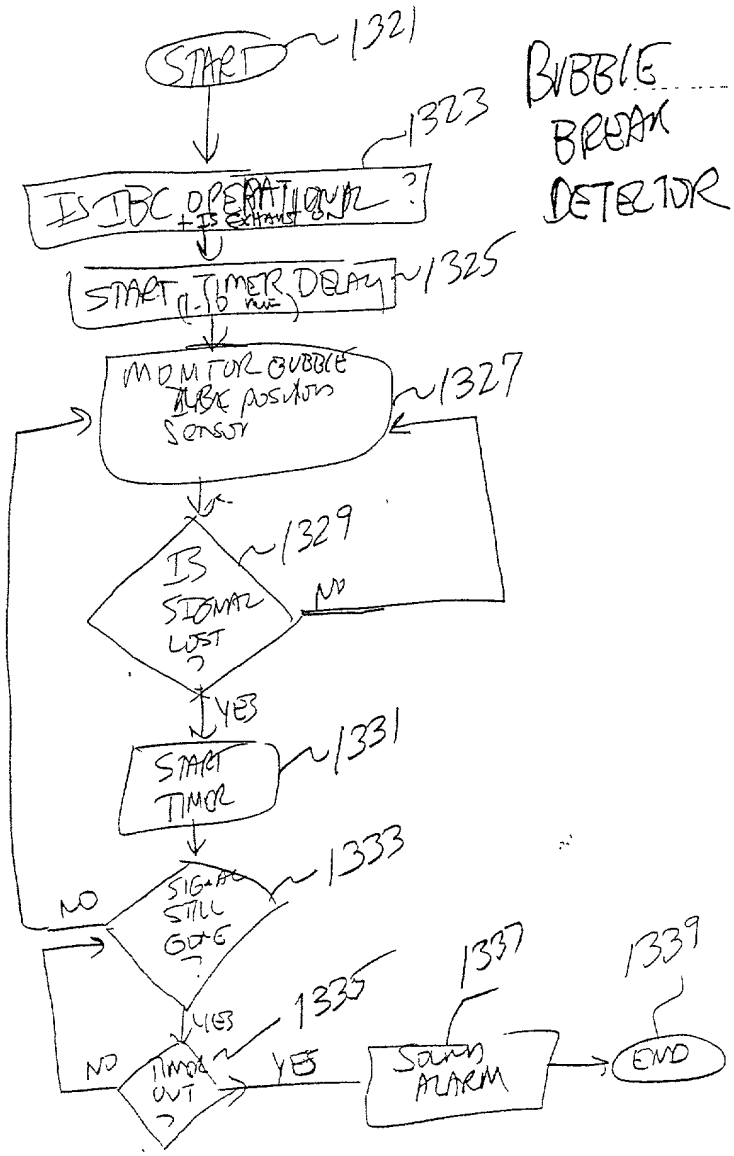


FIGURE 37M

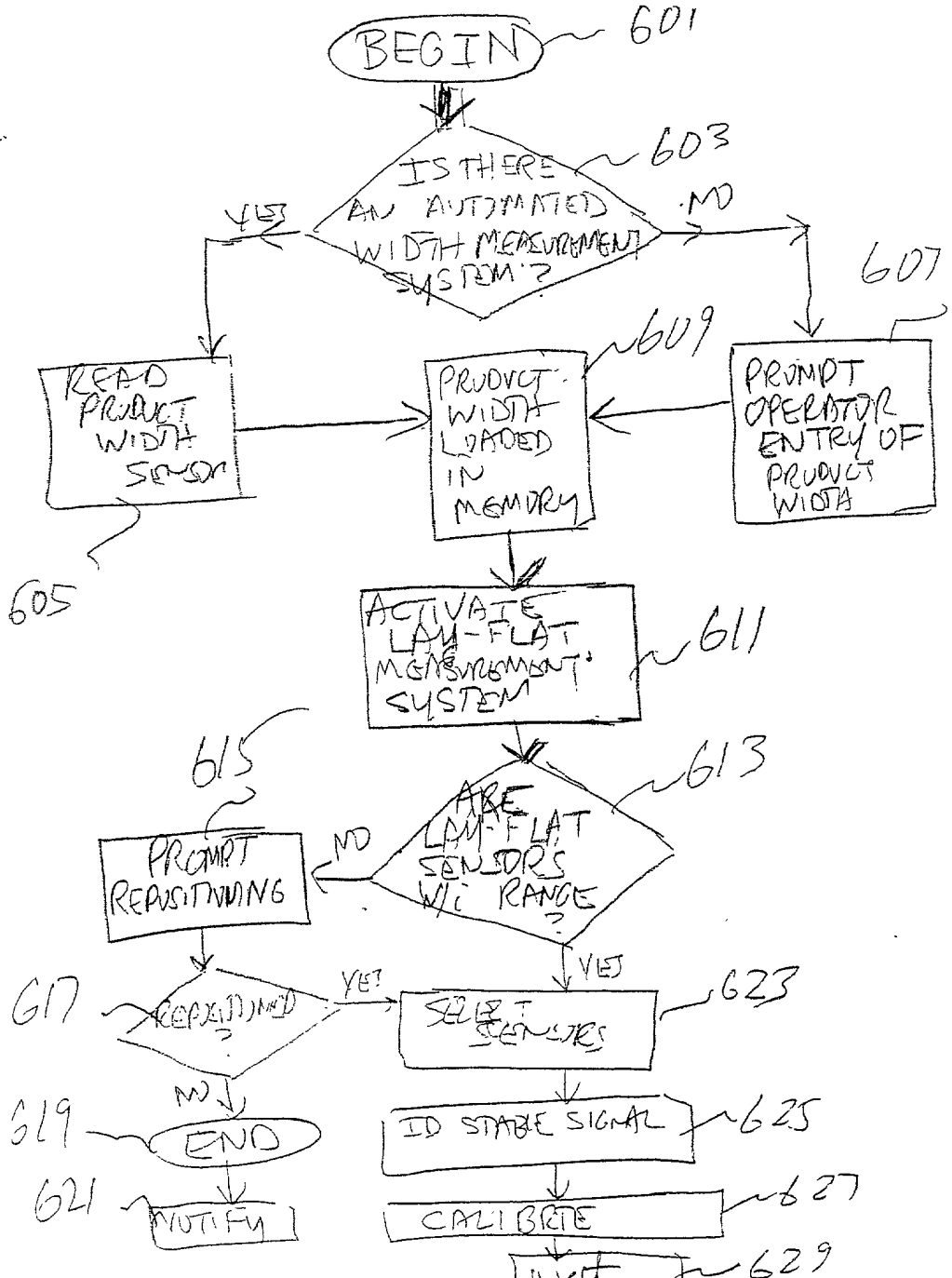

BEGIN
601
IS THERE AN AUTOMATED WIDTH MEASUREMENT SYSTEM?
603
YES
NO
READ PRODUCT WIDTH SENSOR
605
PRODUCT WIDTH LOADED IN MEMORY
609
PROMPT OPERATOR ENTRY OF PRODUCT WIDTH
607
ACTIVATE LAM-FLAT MEASUREMENT SYSTEM
611
ARE LAM-FLAT SENSORS W/ RANGE ?
613
NO
PROMPT REPOSITIONING
615
YES
SELECT SENSORS
623
ID STABLE SIGNAL
625
CALIBRATE
627
INJECT
629
KEEP TRYING ?
617
YES
NO
END
619
NOTIFY
621

FIGURE 38

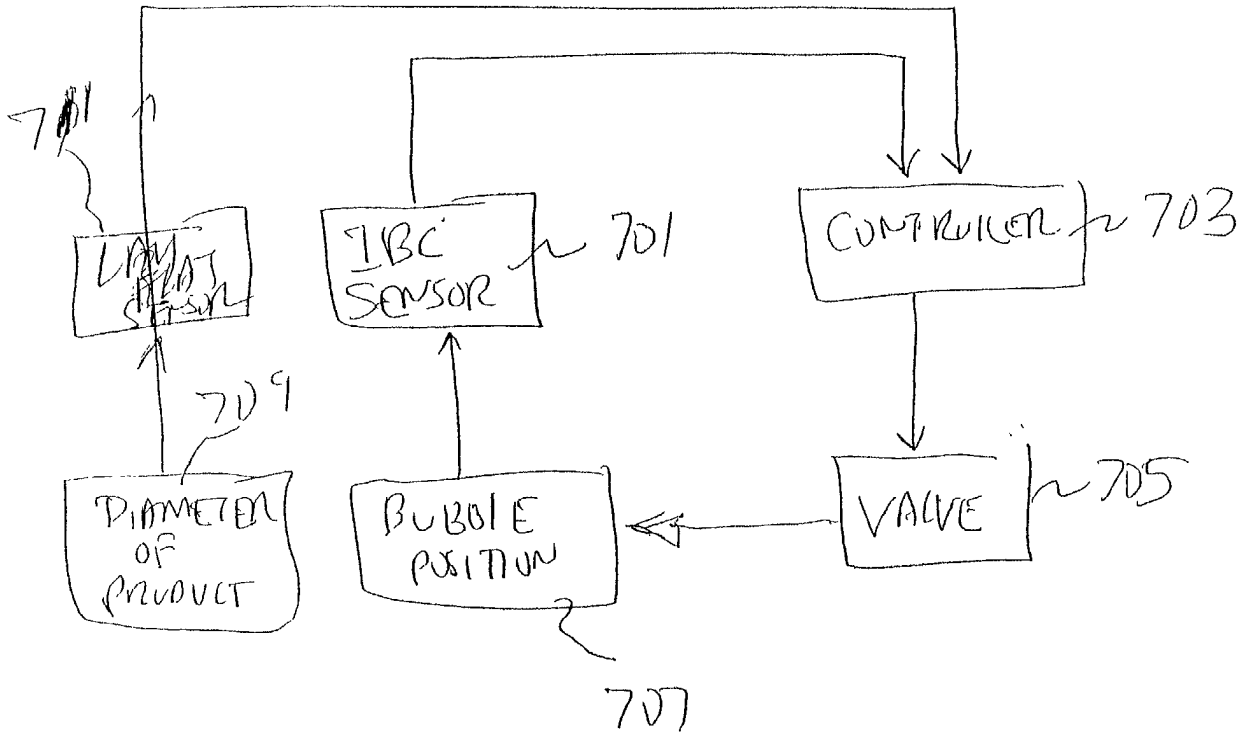

LAY
IBC
SENSOR
701
CONTROLLER
703
709
DIAMETER
OF
PRODUCT
BUBBLE
POSITION
VALVE
705
707

FIGURE 39

05050804.060604

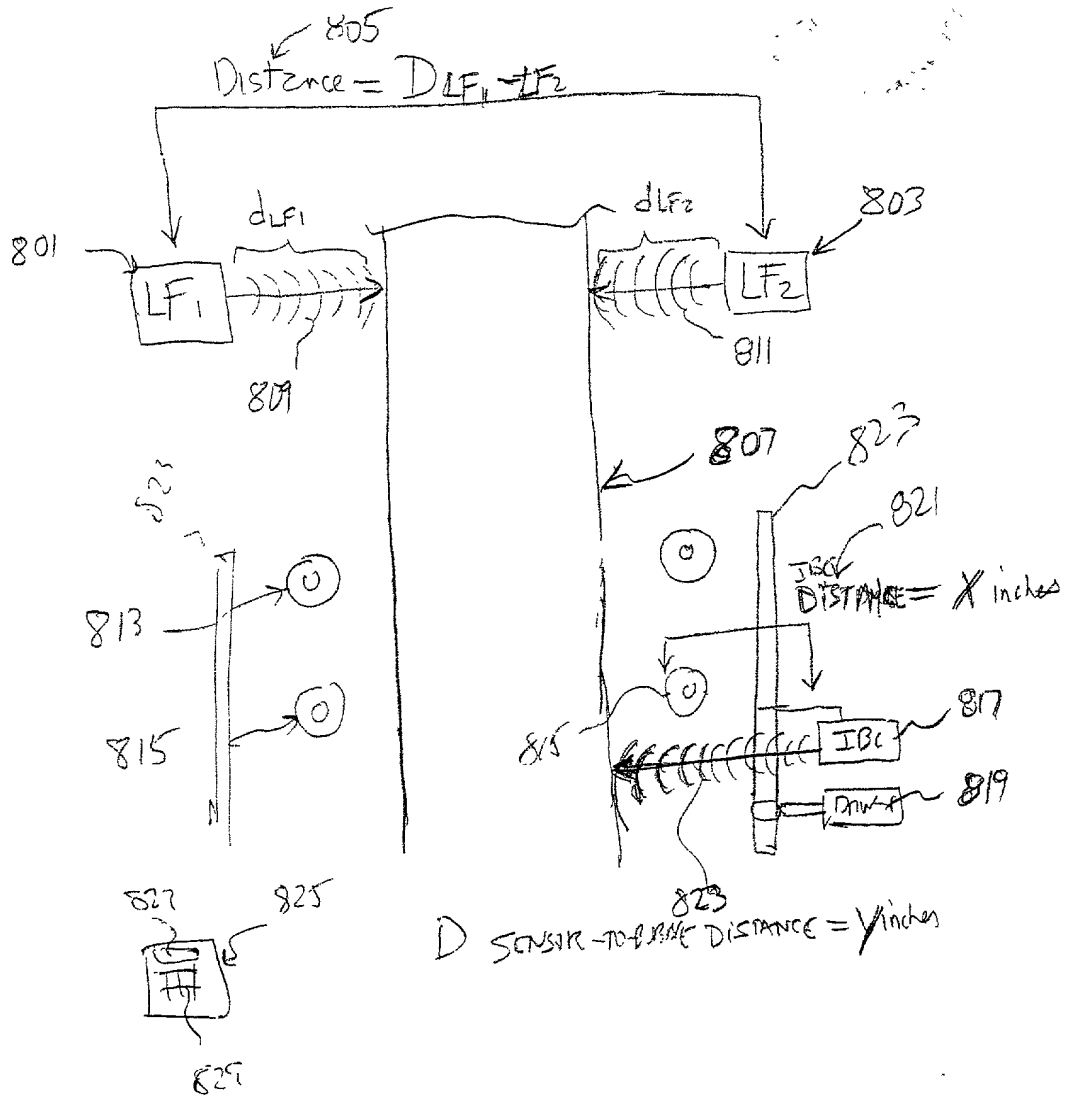


FIGURE 40

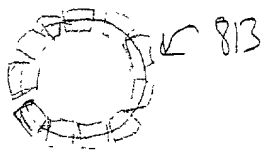


FIGURE 41

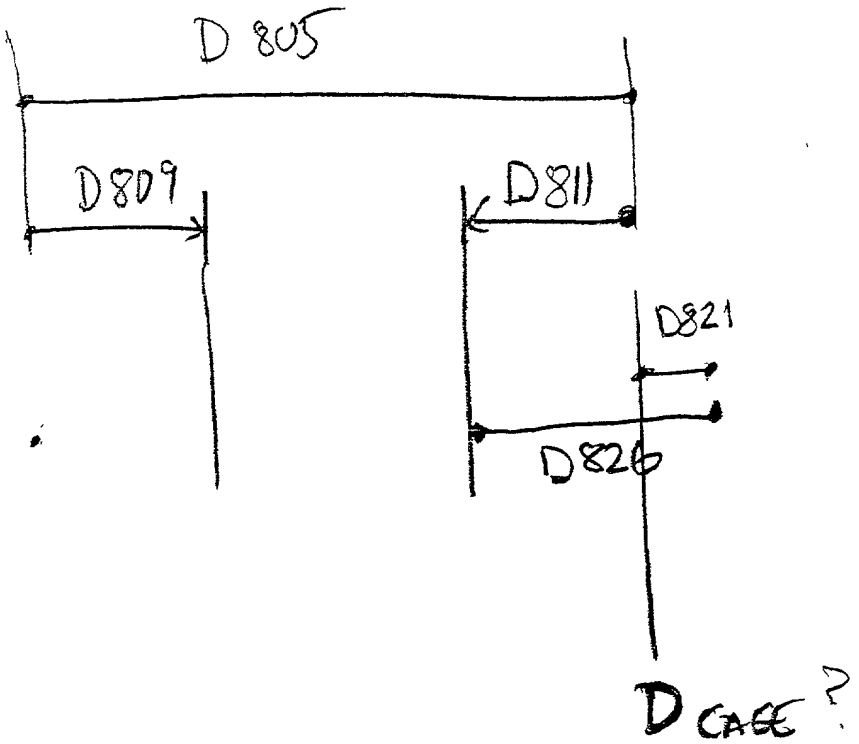


FIG 4.2

$$D_{CAGE} = (D805 - D809 - D811) + (D826 - D821)$$

09850854-081501

FOR [illegible] MODE

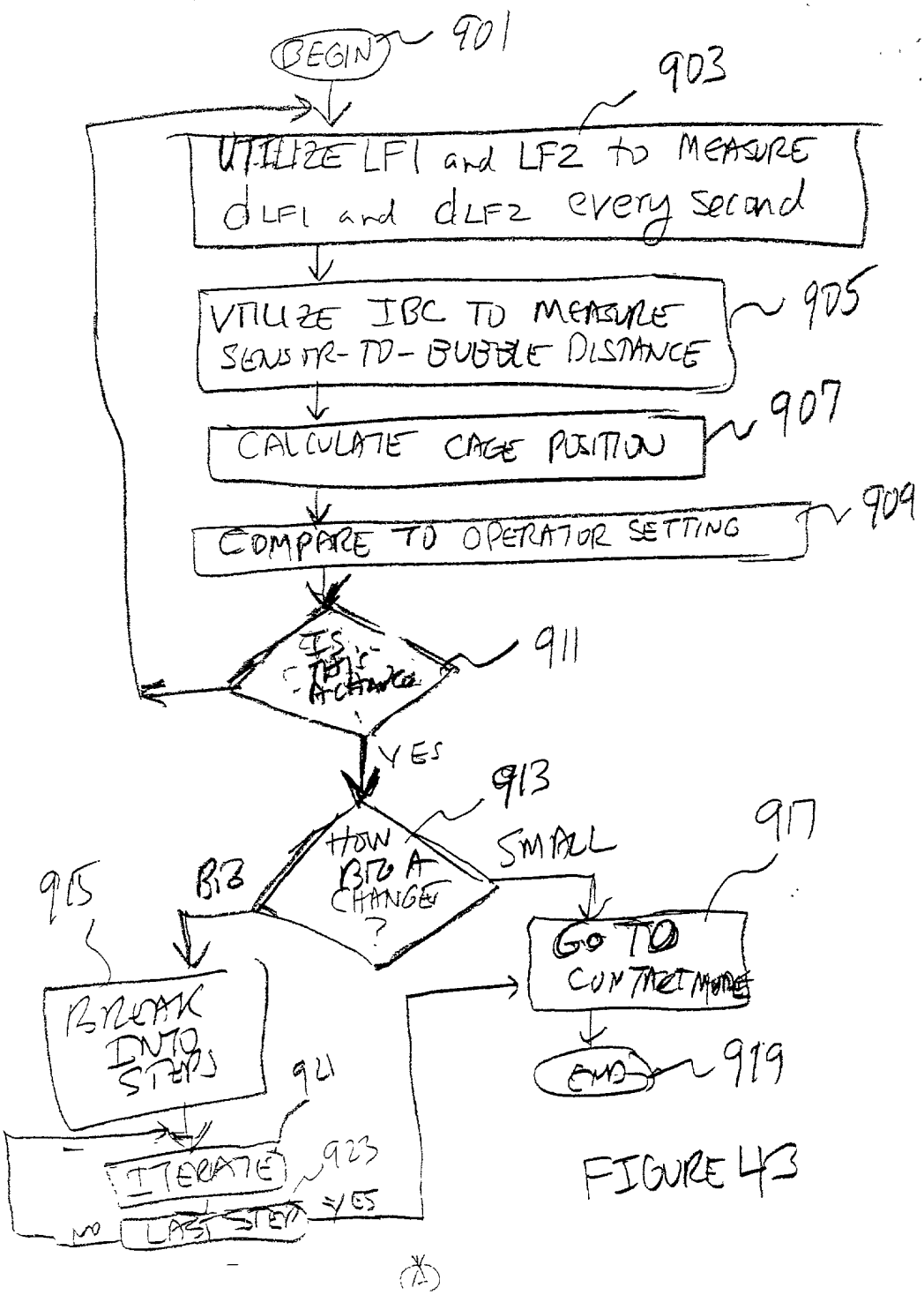


FIGURE 4B

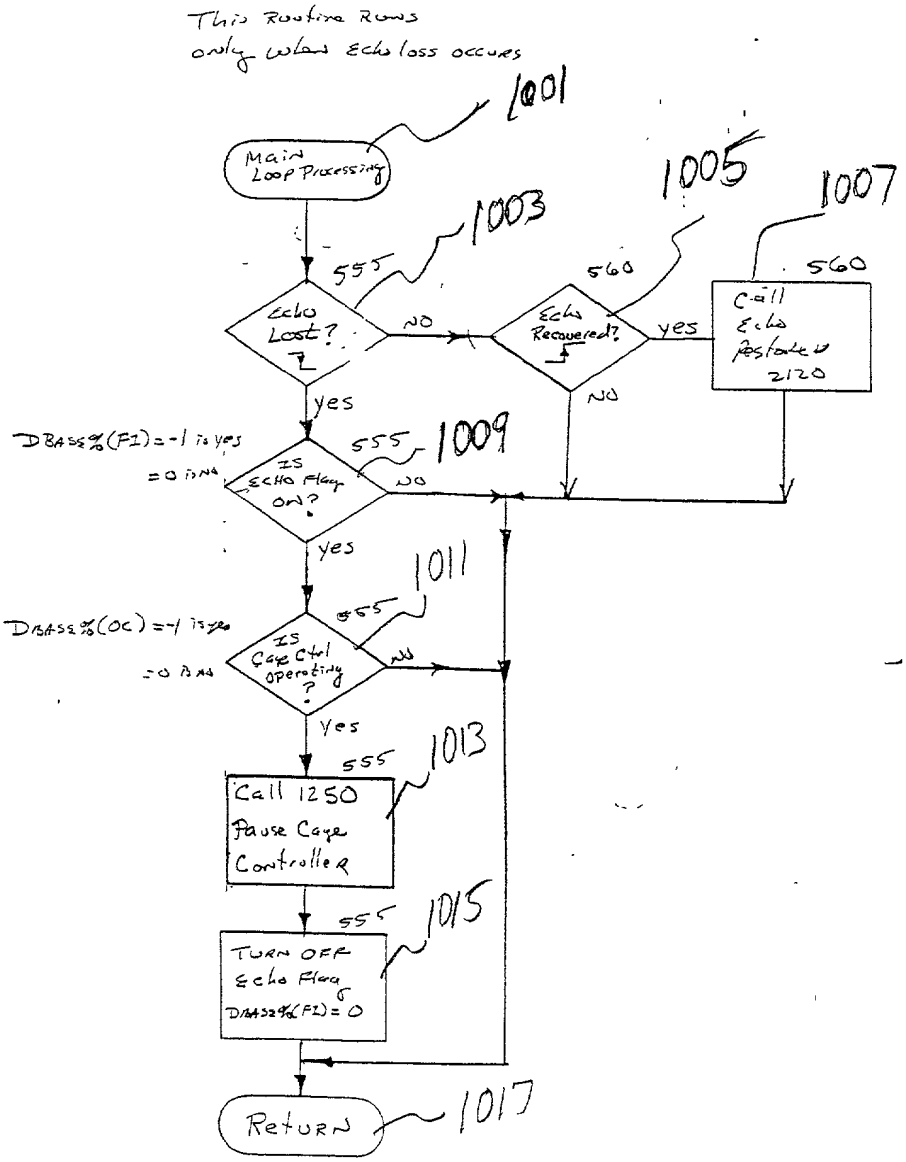

This Routine Runs only when Echo loss occurs
1001
Main Loop Processing
1003
555
Echo Lost?
NO
1005
560
Echo Recovered?
yes
1007
560
Call Echo Restored 2120
NO
yes
DBASE%(F1) = -1 is yes = 0 is no
555
1009
IS ECHO Flag ON?
NO
yes
DBASE%(OC) = -1 is yes = 0 is no
555
1011
IS Cage Ctrl operating ?
NO
yes
555
1013
Call 1250 Pause Cage Controller
555
1015
TURN OFF Echo Flag DBASE%(F1) = 0
Return
1017

FIGURE 44A

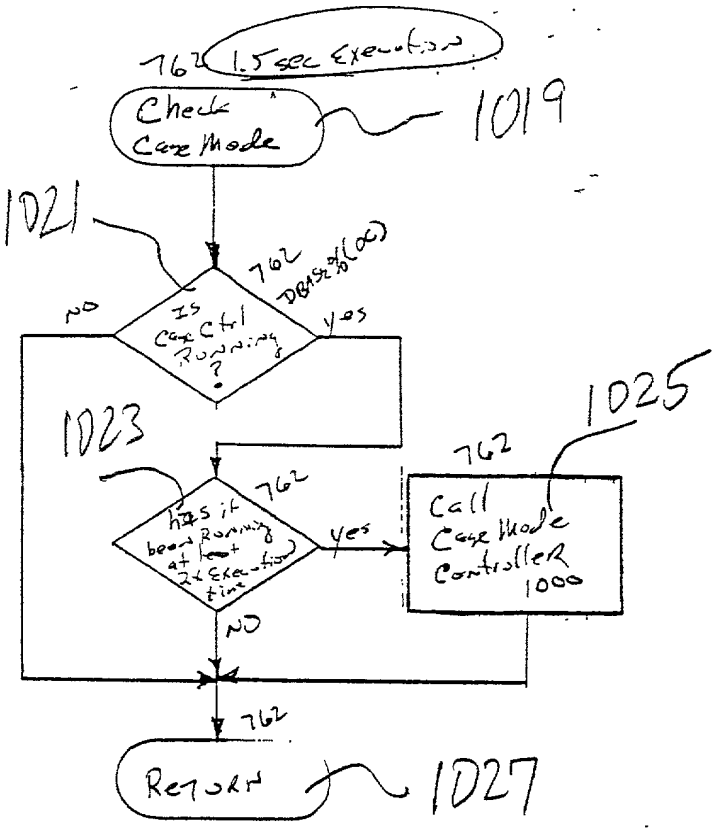

762
1.5 sec Execution
Check Case Mode
1019
1021
762
Is Case Ctrl Running?
DBASE%(100)
NO
YES
1023
762
Has it been Running for at least 2 Execution time
YES
NO
1025
762
Call Case Mode Controller 1000
762
Return
1027

FIGURE 44B

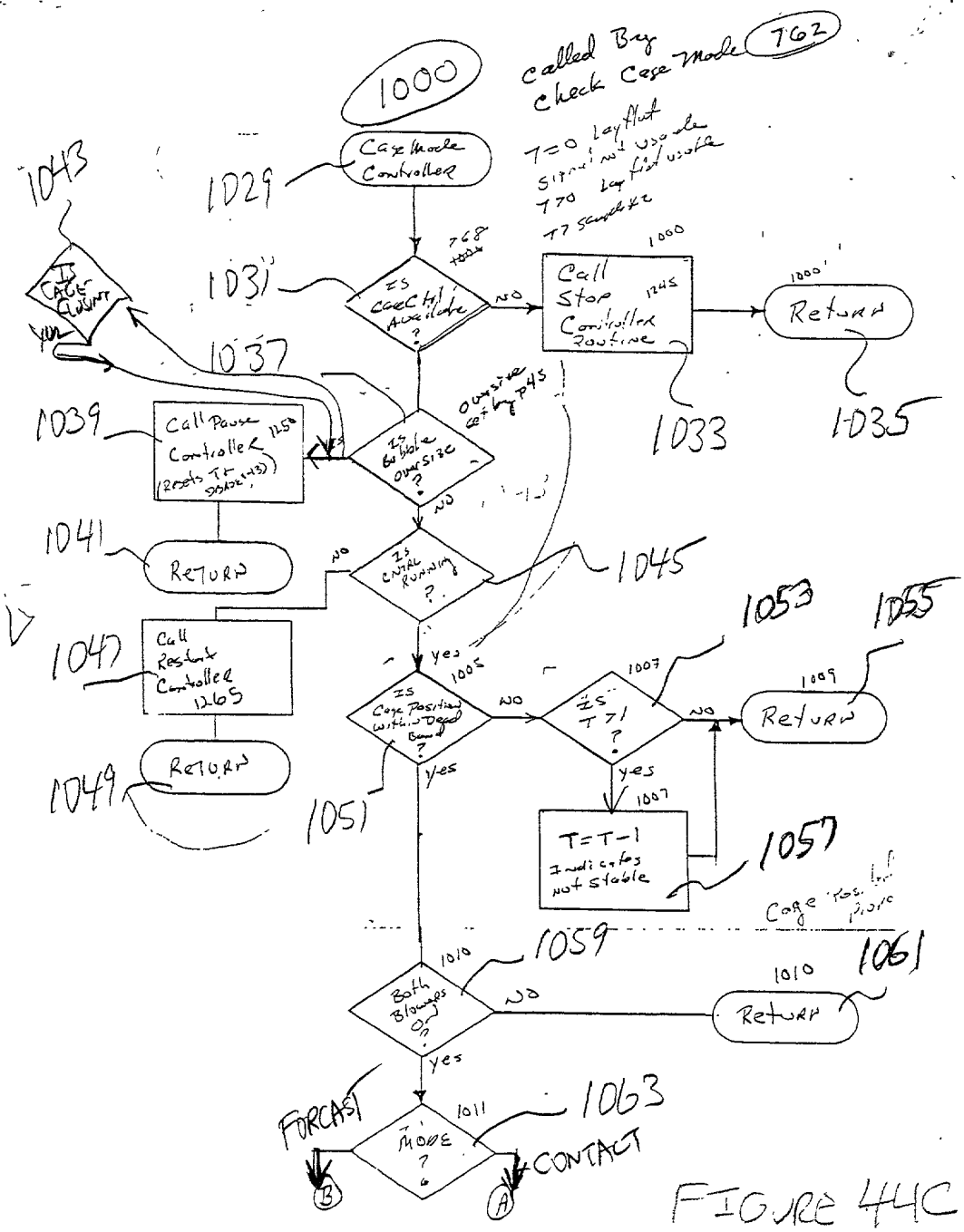

1000
Called By Check Case mode 762
Case Mode Controller
1029
1043
Is Cage Clamped
1031
Is Coach Available ?
768
NO
Call Stop Controller Routine
1045
1000'
Return
1035
1033
1037
1039
Call Pause Controller
1150
Is Vehicle Oversize ?
Oversize setting pHS
NO
1041
Return
Is Cntrl Running ?
1045
1047
Call Restart Controller
1165
1049
Return
yes
1005
Is Cage Position within Desired Band ?
NO
1007
Is T ?
1053
1055
1009
Return
1051
yes
1007
T=T-1
Indicates not Stable
1057
Cage Pos. Int. Prior
1059
1010
Both Blowers On ?
NO
1010
1061
Return
yes
1011
Mode ?
1063
FORCAST
CONTACT
B
A

FIGURE 44C

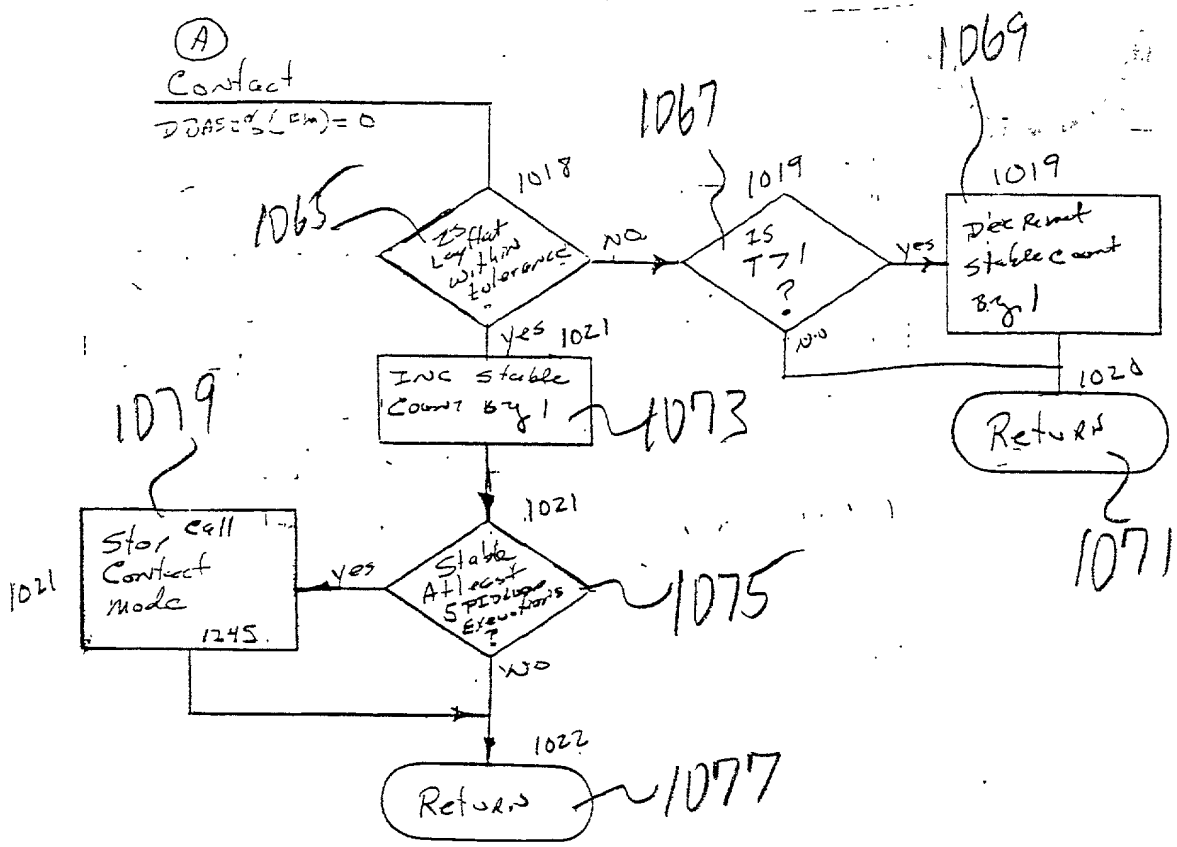


FIGURE 44D

CONTACT MODE

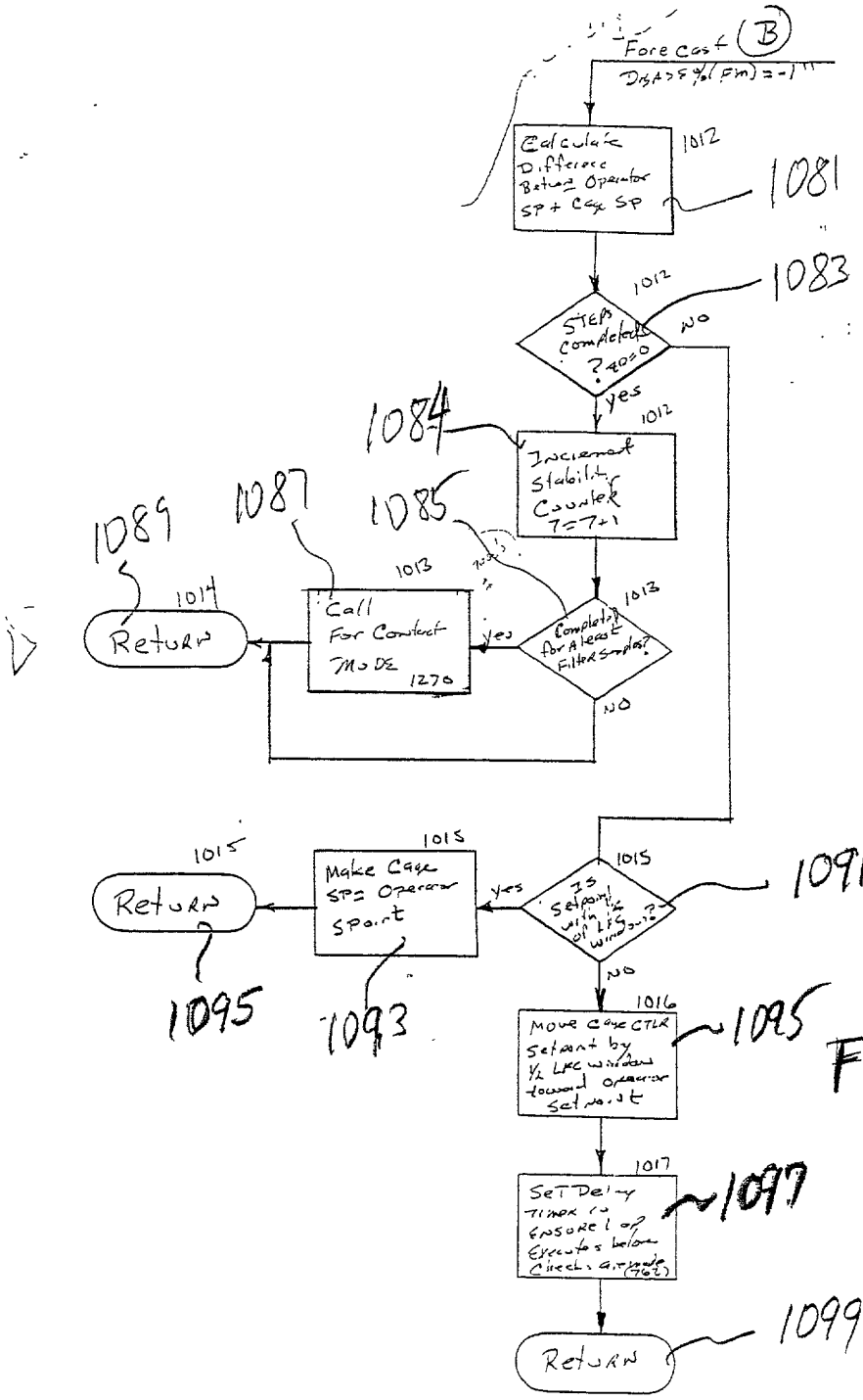


FIGURE 44E
FORCAST MODE

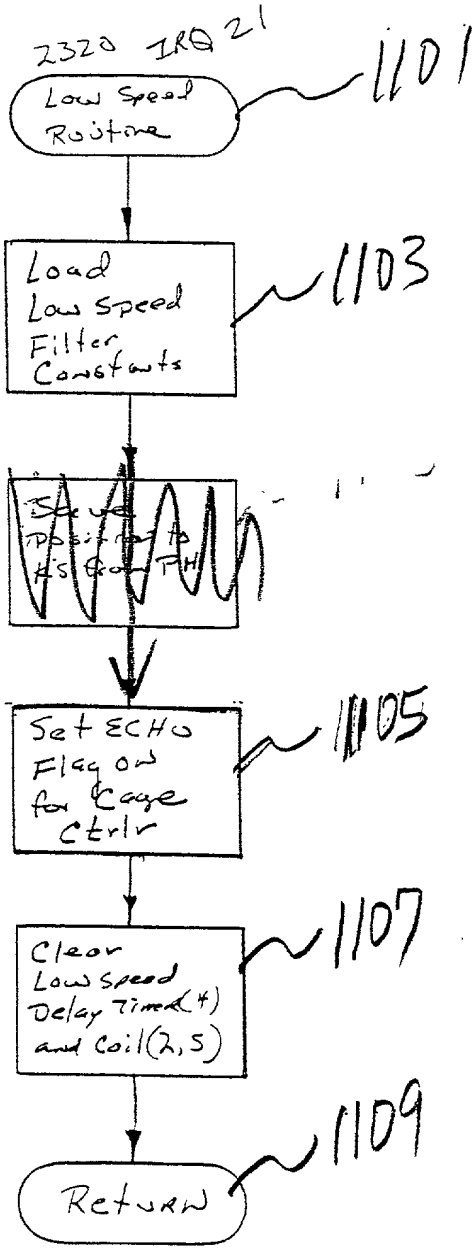

2320 IRQ 21
Low Speed Routine
1101
Load Low Speed Filter Constants
1103
Set ECHO Flag on for Cage Ctrlr
1105
Clear Low Speed Delay Timer(4) and Coil(2,5)
1107
Return
1109

FIGURE 44F

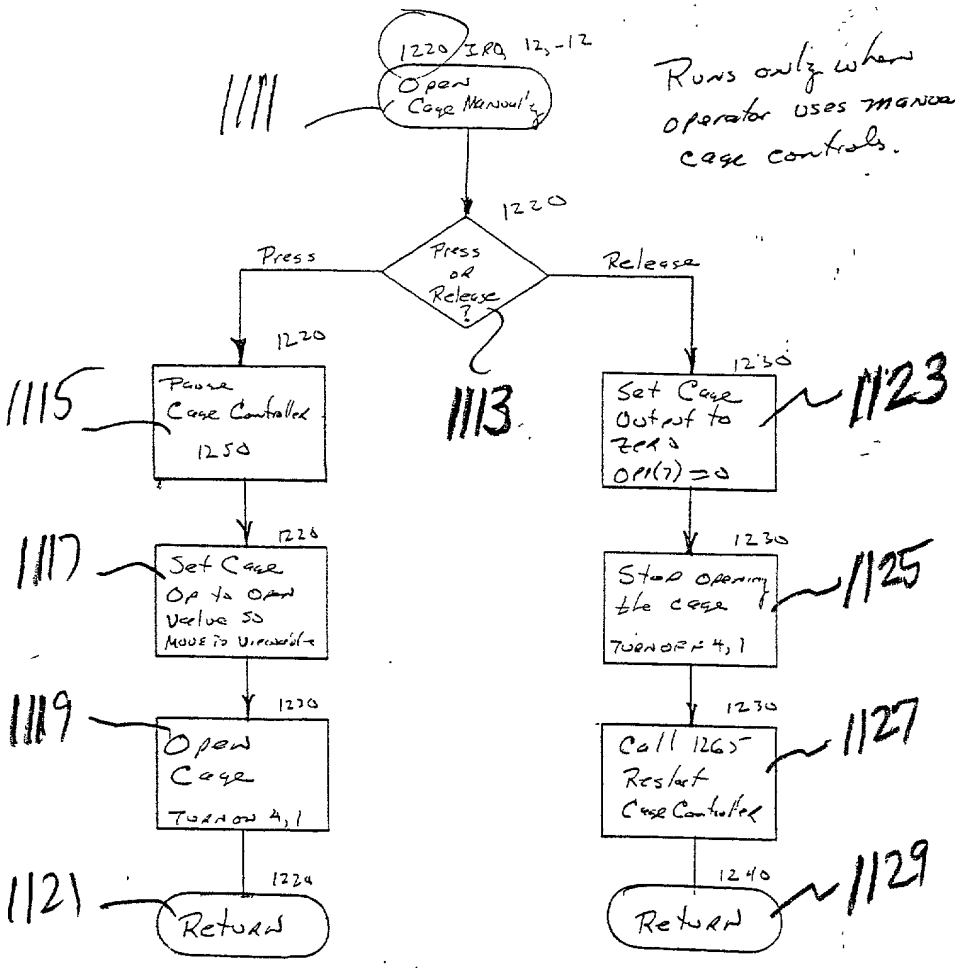

1220 IRQ 12, -12
Open Cage Manually
1111
Runs only when operator uses manual cage controls.
1220
Press or Release ?
Press
Release
1220
Pause Cage Controller 1250
1115
1113
1230
Set Cage Output to zero OP1(7) = 0
1123
1226
Set Cage Op to Open Value 50 Mode to Unavailable
1117
1230
Stop opening the cage TURNOFF 4, 1
1125
1228
Open Cage TURNON 4, 1
1119
1230
Call 1265 Restart Cage Controller
1127
1224
Return
1121
1240
Return
1129

FIGURE 44G

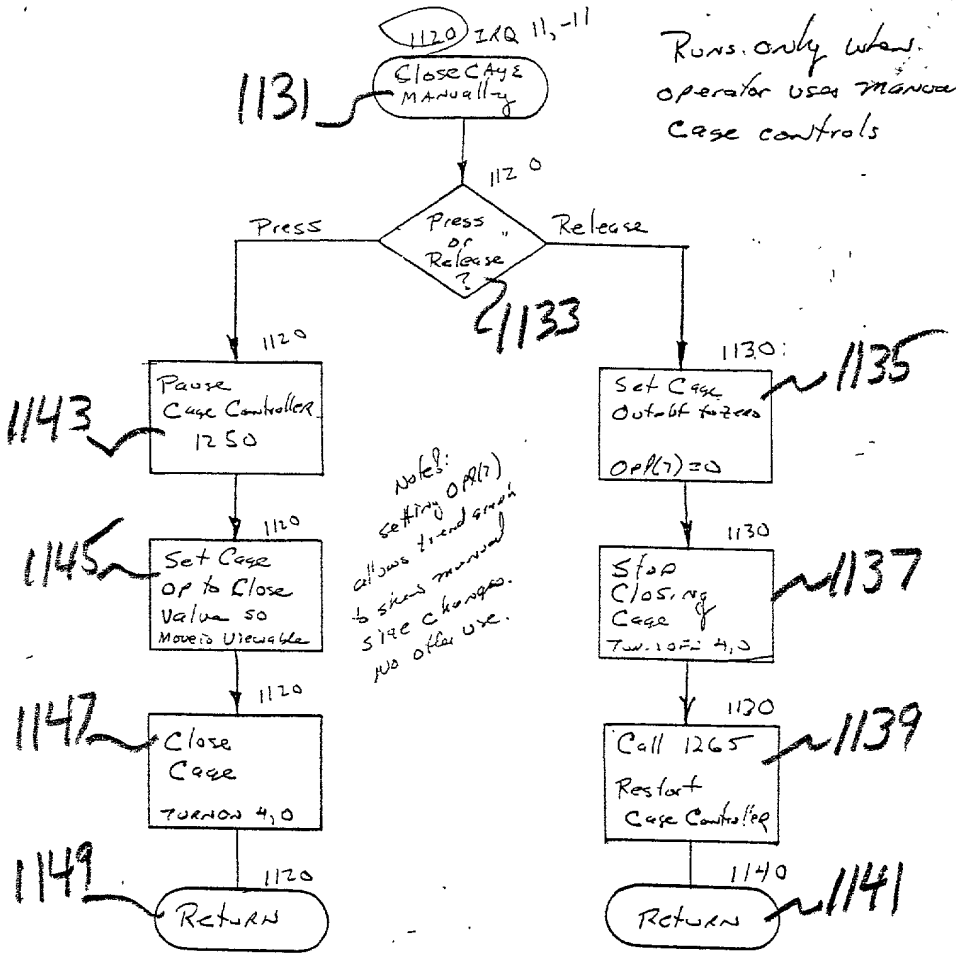

1120 IRQ 11, -11
1131
Close Case Manually
Runs only when operator uses manual case controls
1120
Press or Release ?
1133
Press
Release
1120
1143
Pause Case Controller 1250
1120
1145
Set Case Op to Close Valve 50 Moves Uncouple
1120
1147
Close Case
TURNON 4,0
1120
1149
Return
Notes: setting OPR(7) allows trend graph to show manual step changes. Has other use.
1130
1135
Set Case Outputs to zero
OPR(7)=0
1130
1137
Stop Closing Case
TURNOFF 4,0
1130
1139
Call 1265
Restart Case Controller
1140
1141
Return

FIGURE 44H

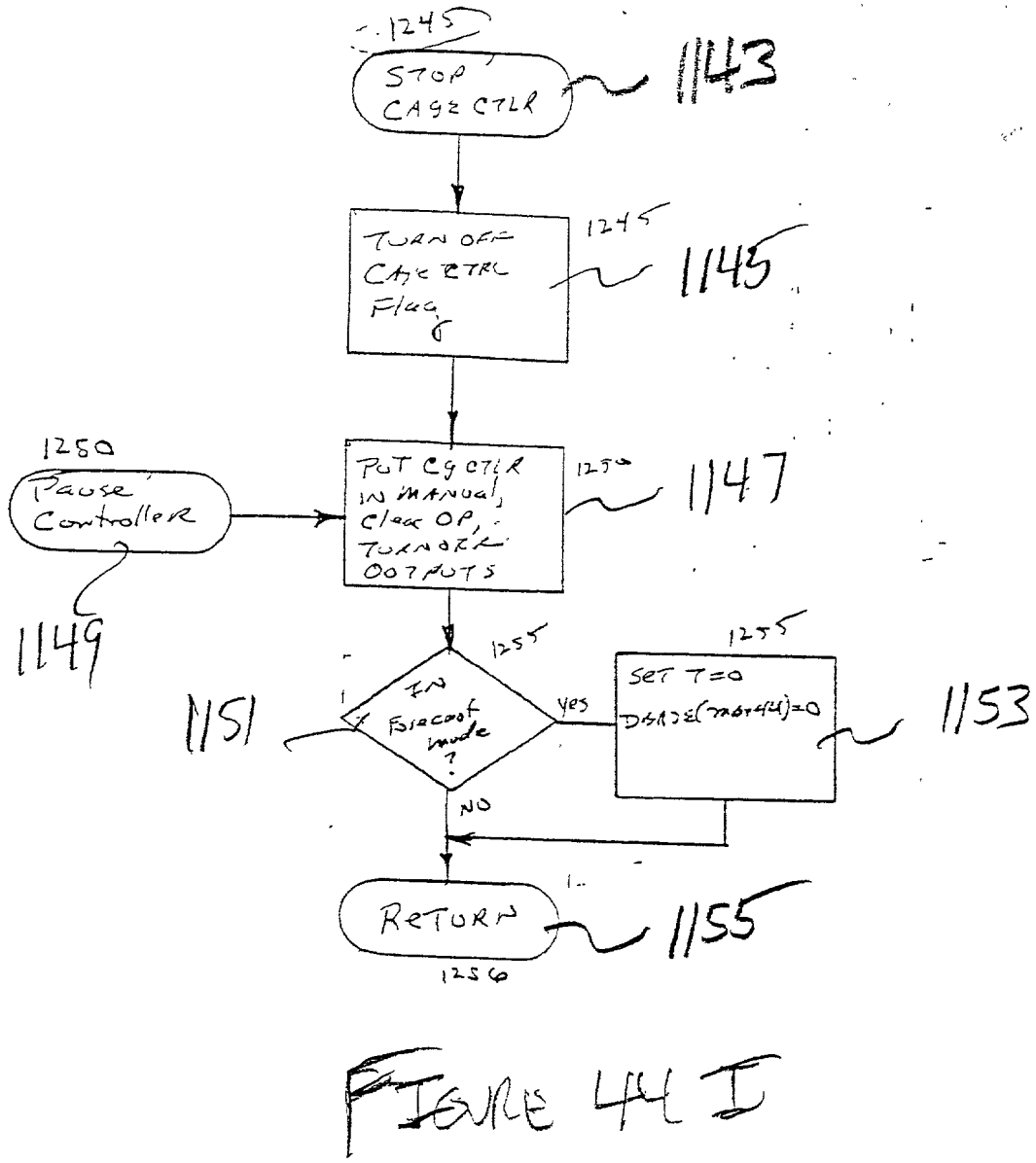

1245
STOP CAGE CTLR
1143
TURN OFF CAGE CTRL Flag
1245
1145
1250
Pause Controller
1149
PUT CAGE CTLR IN MANUAL, Clear OP, TURN OFF OUTPUTS
1250
1147
1255
IN Bracket Mode ?
1151
yes
SET T=0
DELAY(TABLE44)=0
1255
1153
NO
RETURN
1256
1155

FIGURE 44I

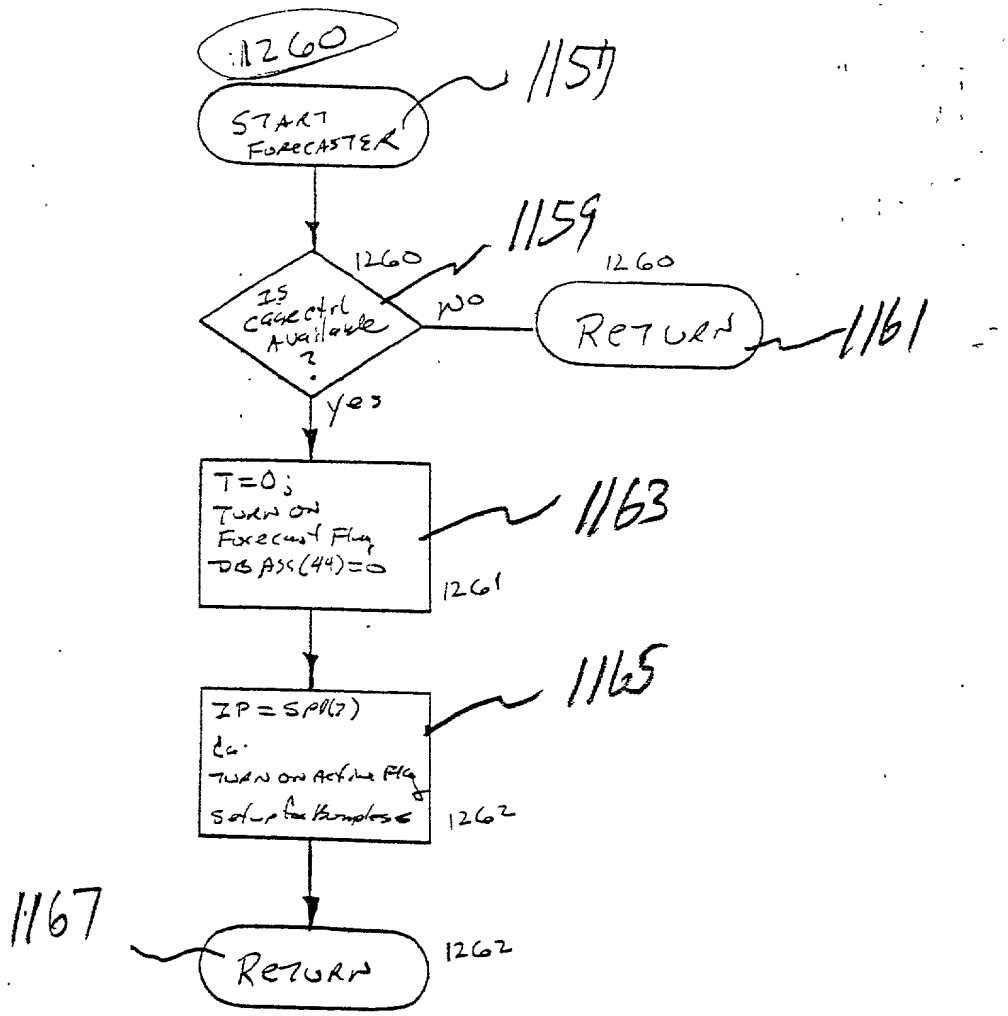

1260
START FORECASTER
1157
1159
1260
IS CGExCtrl Available ?
NO
1260
RETURN
1161
yes
T=0;
Turn On Forecast Flag
DBASS(44)=0
1261
1163
IP=SP(7)
&c.
TURN ON Active Flag
Setup for Template
1262
1165
1167
RETURN
1262

FIGURE 44J

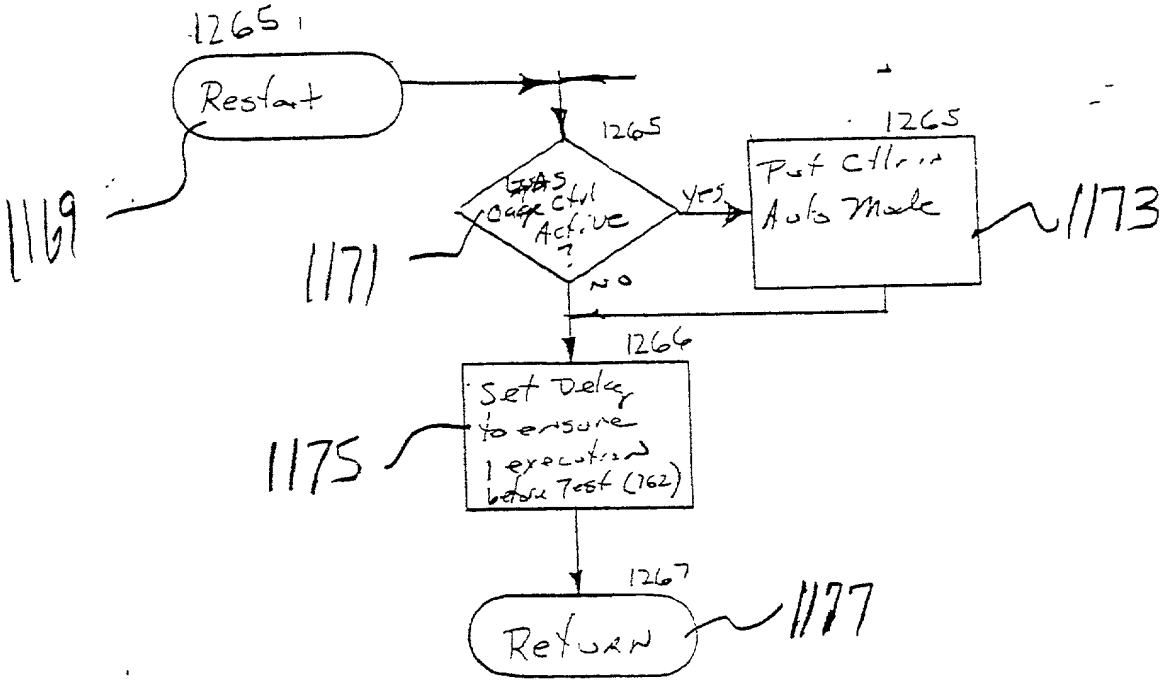

1265
Restart
1169
1265
Gas Ctrl Active ?
1171
YES
NO
1265
Put Ctlr in Auto Mode
1173
1266
Set Delay to ensure 1 execution before Test (162)
1175
1267
Return
1177

FIGURE 44K

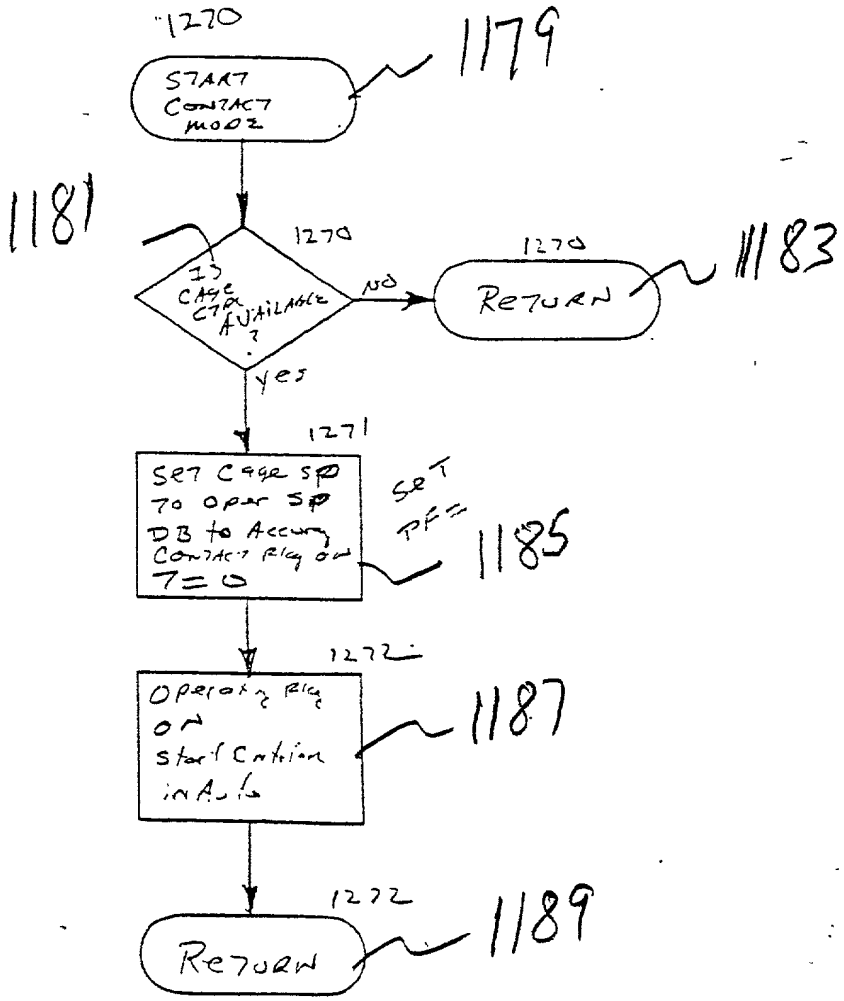

1270
START CONTACT MODE
1179
1181
1270
IS CAGE CTR AVAILABLE ?
NO
1270
RETURN
1183
YES
1271
SET CAGE SPD TO OPER SPD DB to Accum CONTACT Rlay on Z=0
SET PF=
1185
1272
Operating Rlay ON Start Contion in Auto
1187
1272
RETURN
1189

FIGURE 44

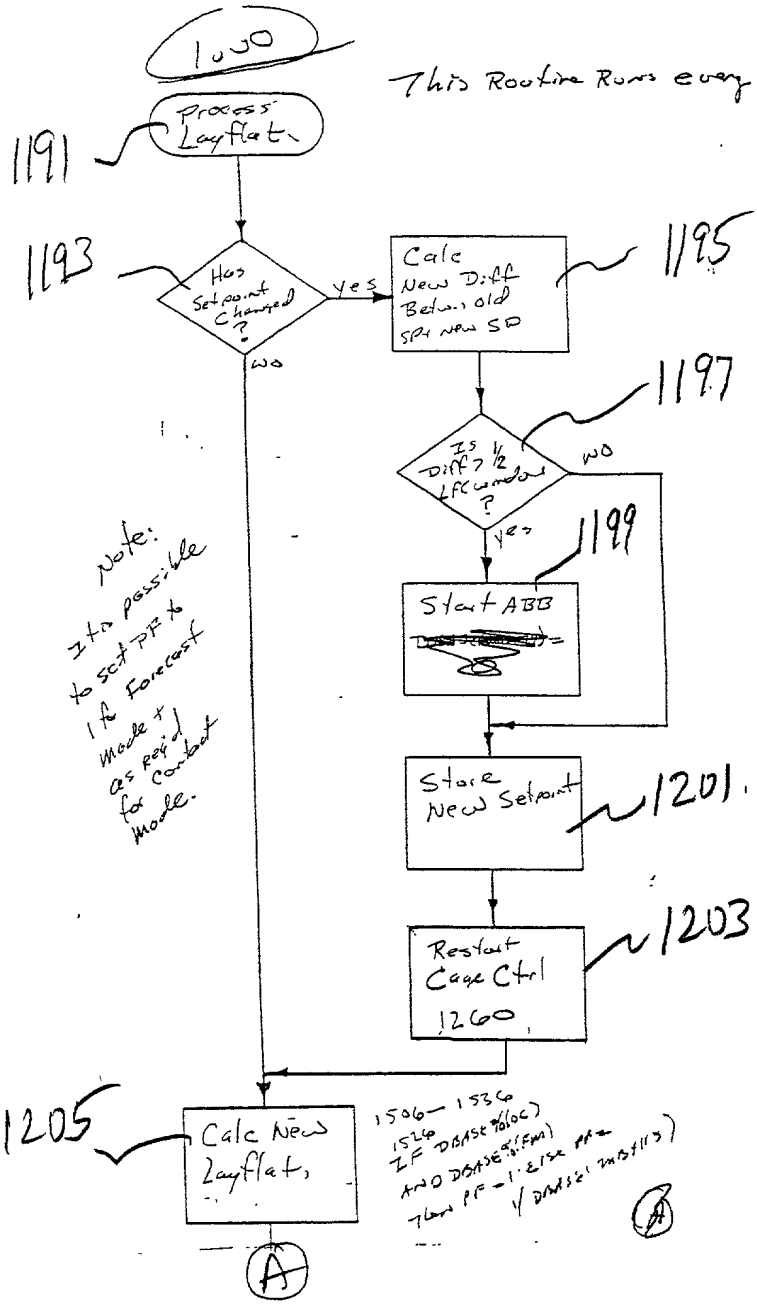

1100
This Routine Runs every second
Process Layflat
1191
1193
Has Setpoint Changed ?
Yes
No
Calc New Diff Between old SP & New SP
1195
1197
Is Diff > 1/2 Effective Deadband ?
No
Yes
1199
Start ABB
Store New Setpoint
1201
Restart Cage Ctrl 1260
1203
1205
Calc New Layflat
Note: It is possible to set PF to 1 if Forecast Mode is used as Rapid Control for Mode.
1506 — 1536
1526
IF DBASE% (LOC)
AND DBASE% (FAM)
THEN PF = 1 - ELSE PF =
1 / DBASE% (LOC) (FAM)
A
A

FIGURE 44M

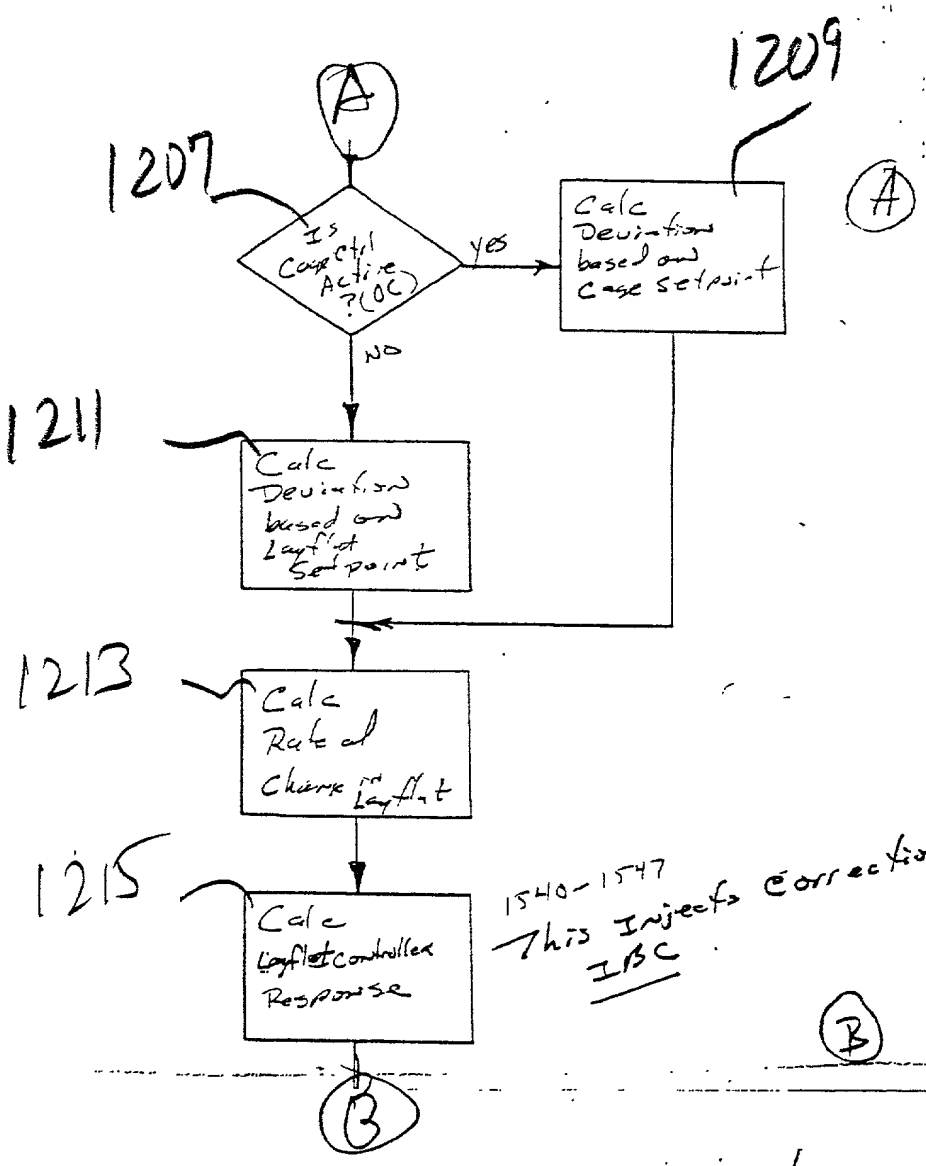
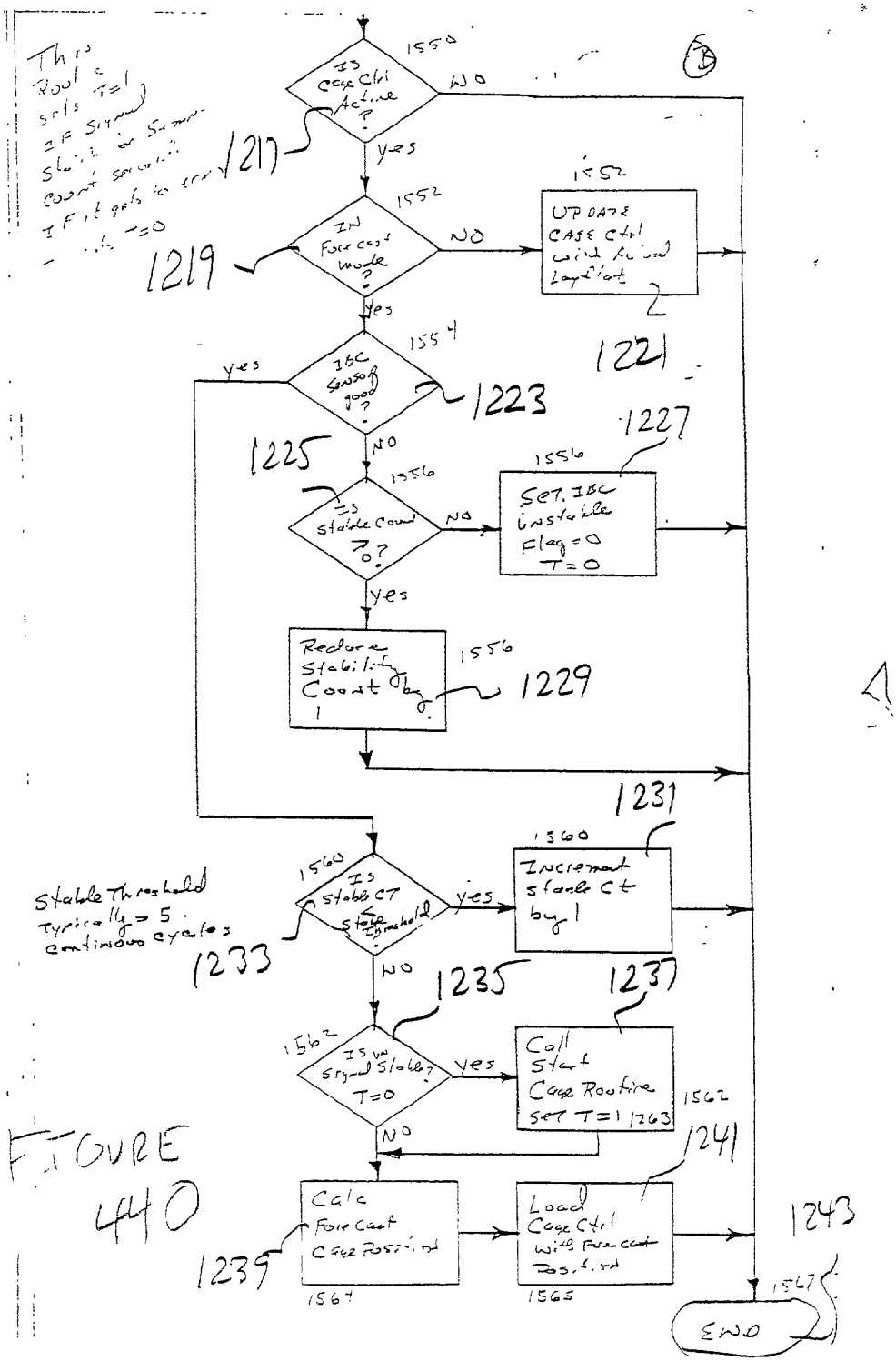

A
1207
Is Coop ctrl Active ? (OC)
yes
NO
1209
Calc Deviation based on Coop setpoint
A
1211
Calc Deviation based on Layflat Setpoint
1213
Calc Rate of Change Layflat
1215
Calc Layflat controller Response
1540-1547
This Injects correction signal to IBC
B
B

FIGURE 44N


This Routine sets T=1 if Signal Status is Stable. Count Sequence. If it gets in error T=0
1550
Is Cage Ctrl Active?
NO
yes
1217
1552
IN Force cast Mode?
NO
yes
1219
1554
IBC Sensor good?
yes
1223
NO
1225
1556
Is Stable Count >0?
NO
yes
1227
Set IBC unstable Flag=0 T=0
Reduce Stability Count by 1
1556
1229
1231
1560
Is Stable CT < Stable Threshold
yes
NO
1233
Stable Threshold Typically = 5 continuous cycles
1360
Increment Stable Ct by 1
1235
1562
Is IBC Signal Stable? T=0
yes
NO
1237
Call Start Cage Routine set T=1 1263
1562
1241
Calc Force Cast Cage Position
1239
1567
Load Cage Ctrl with Forecast Pos. Cmd
1565
1243
1567
END
FIGURE 4A
4/0

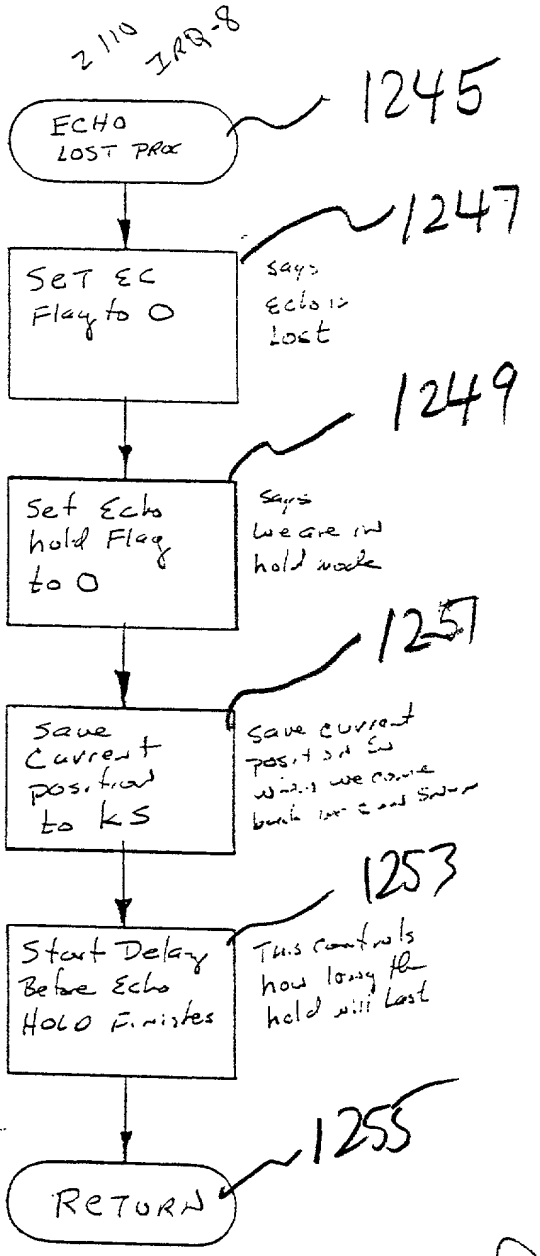

Z 110
IRQ-8
ECHO LOST PRX
1245
SET EC Flag to 0
says echo is lost
1247
Set Echo hold Flag to 0
says we are in hold mode
1249
Save Current position to KS
Save current position so when we come back we can start
1251
Start Delay Before Echo Hold Finishes
This controls how long the hold will last
1253
RETURN
1255

FIGURE 44P

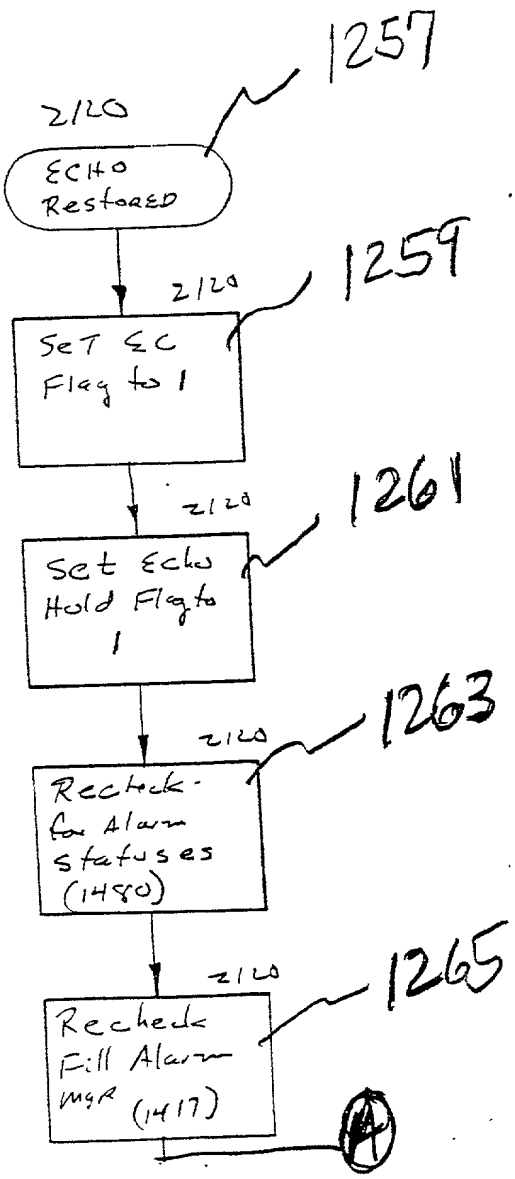

1257
2120
ECHO Restored
1259
2120
Set EC Flag to 1
1261
2120
Set Echo Hold Flag to 1
1263
2120
Recheck for Alarm Statuses (1480)
1265
2120
Recheck Fill Alarm Mgr (1417)
A

FIGURE 44Q

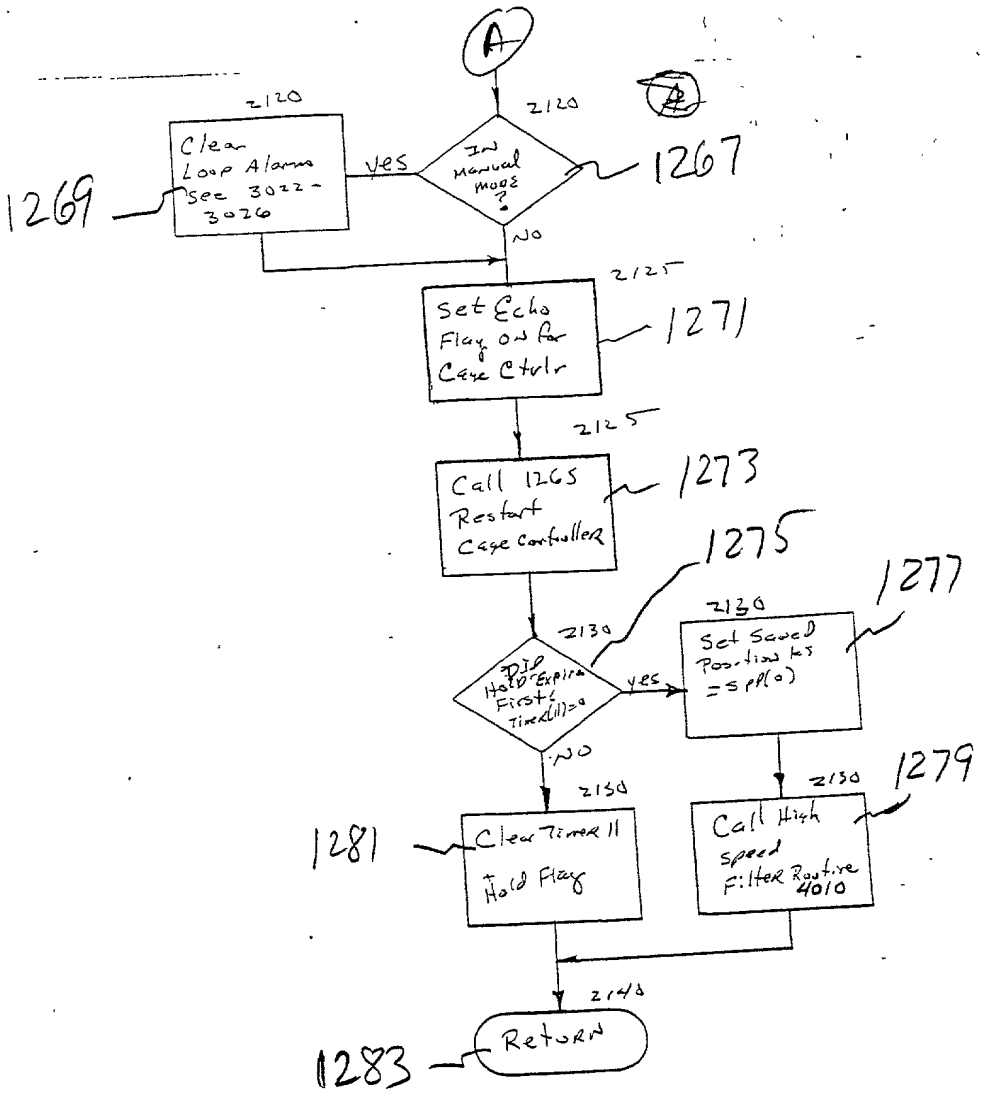

A
2120
Clear Loop Alarms see 3022-3026
1269
yes
2120
In Manual mode ?
1267
NO
2125
Set Echo Flag ON for Cage Ctrlr
1271
2125
Call 1265 Restart Cage Controller
1273
1275
2130
DID Hold Expire First Time(11)=0
yes
1277
2130
Set Saved Position to = SPP(0)
NO
2130
1279
Call High speed Filter Routine 4010
2130
1281
Clear Timer 11 Hold Flag
2140
Return
1283

FIGURE 44R

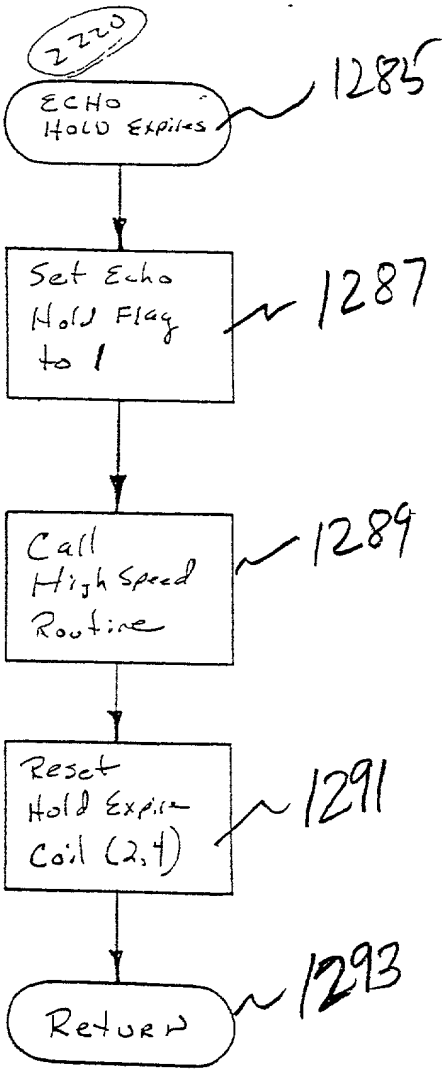

2220
ECHO Hold Expires
1285
Set Echo Hold Flag to 1
1287
Call High Speed Routine
1289
Reset Hold Expire Coil (2,4)
1291
Return
1293

FIGURE 44S

Called By

2120

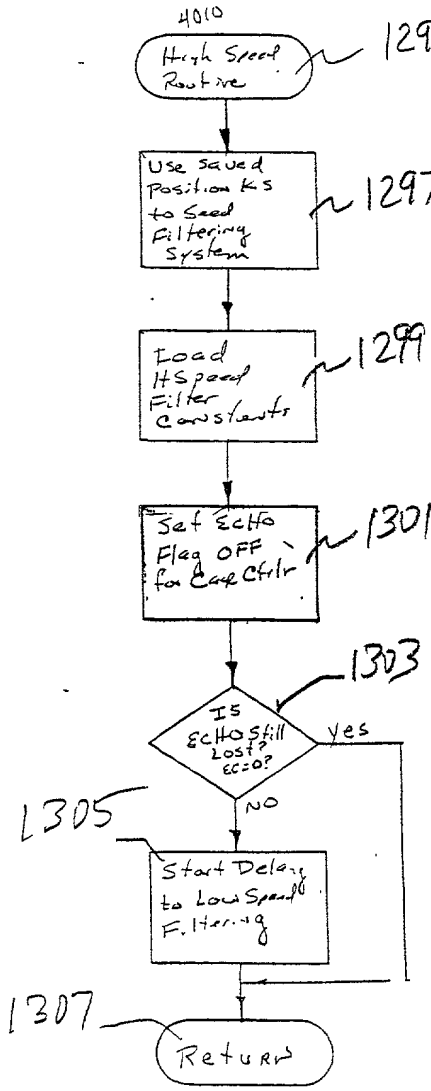


FIGURE 44 T

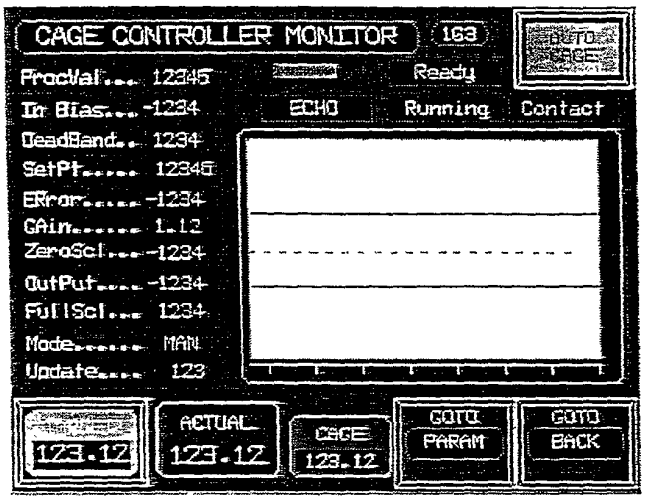

CAGE CONTROLLER MONITOR
163
ProcVal.... 12345
In Bias.... -1234
DeadBand.. 1234
SetPt..... 12345
ERror..... -1234
GAin..... 1.12
ZeroScl... -1234
OutPut.... -1234
FullScl... 1234
Mode..... MAN
Update.... 123
Ready
ECHO
Running
Contact
123.12
ACTUAL
123.12
CAGE
123.12
GOTO
PARAM
GOTO
BACK

FIGURE 45

US 6,880,294 B2

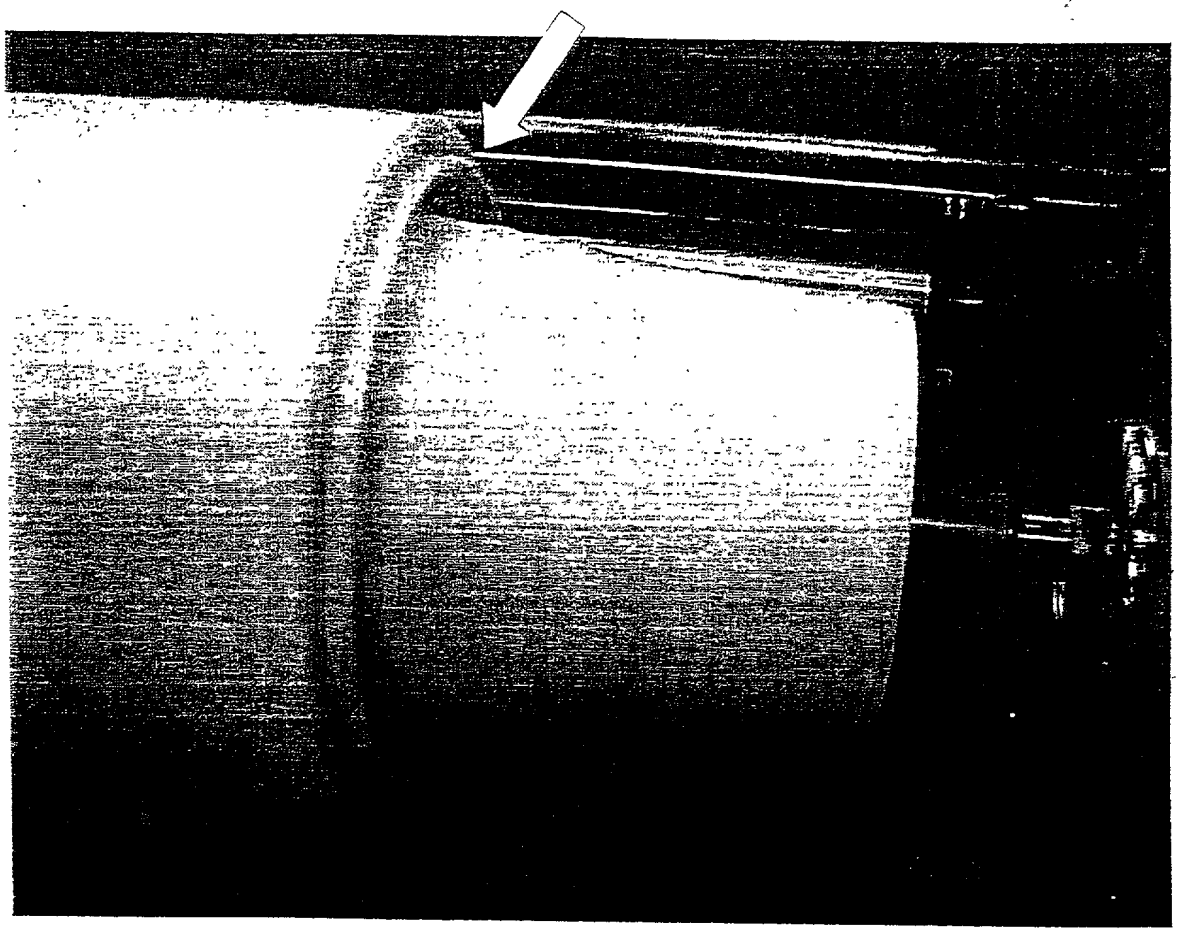


FIGURE 46

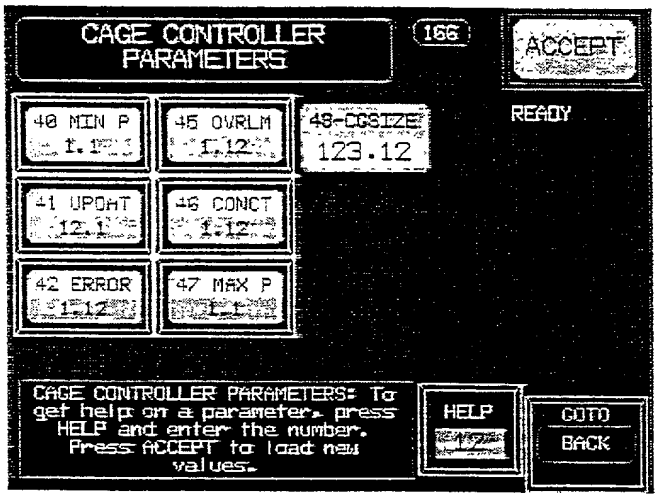

CAGE CONTROLLER PARAMETERS
166
ACCEPT
READY
40 MIN P
45 OVRLM
48-CGSIZE
123.12
41 UPDHT
46 CONCT
42 ERROR
47 MAX P
CAGE CONTROLLER PARAMETERS: To get help on a parameter, press HELP and enter the number. Press ACCEPT to load new values.
HELP
GOTO
BACK

FIGURE 47

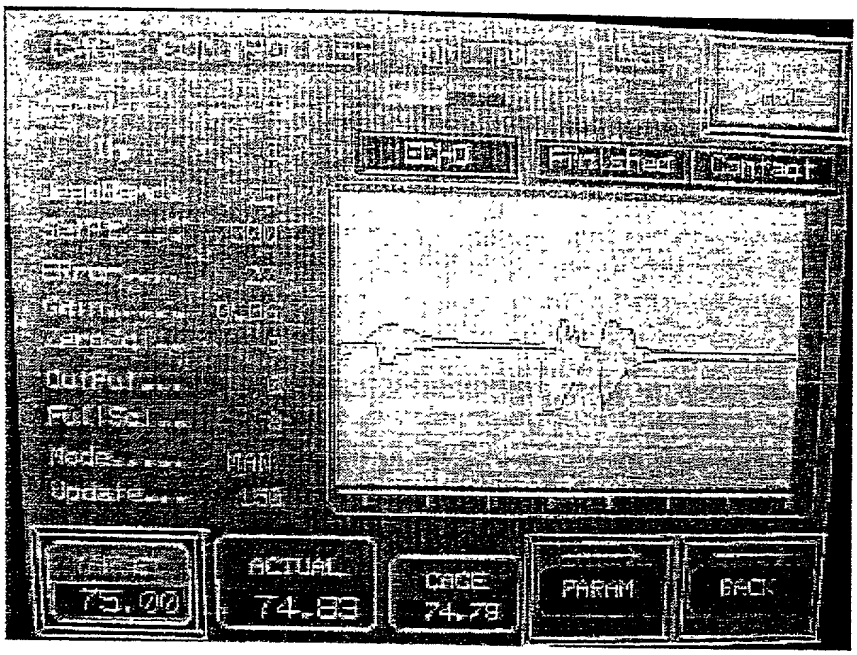


FIGURE 48

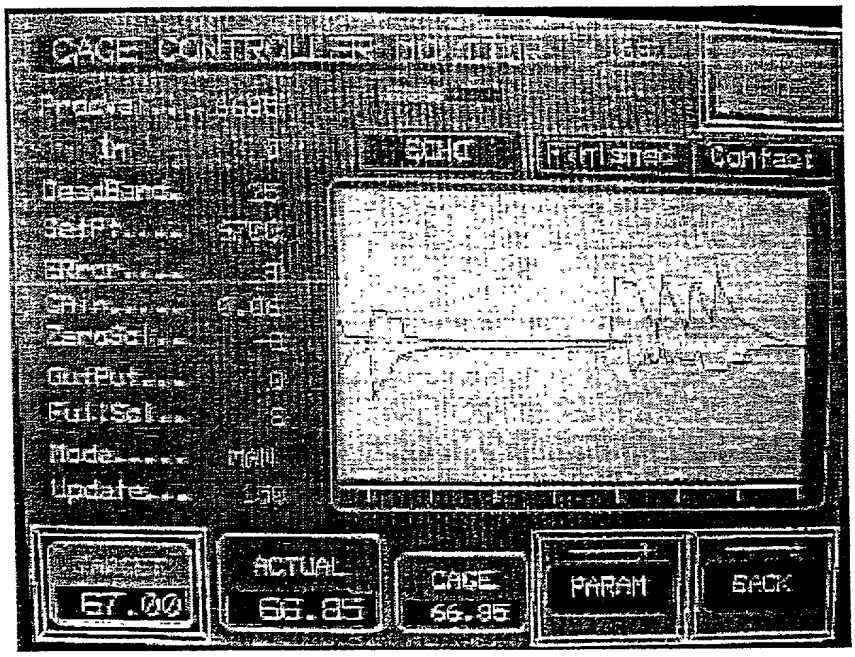

CASE CONTROLLER
Contact
DeadBand
Mode
Update
ACTUAL
66.85
CASE
66.95
PARAM
BACK

FIGURE 49

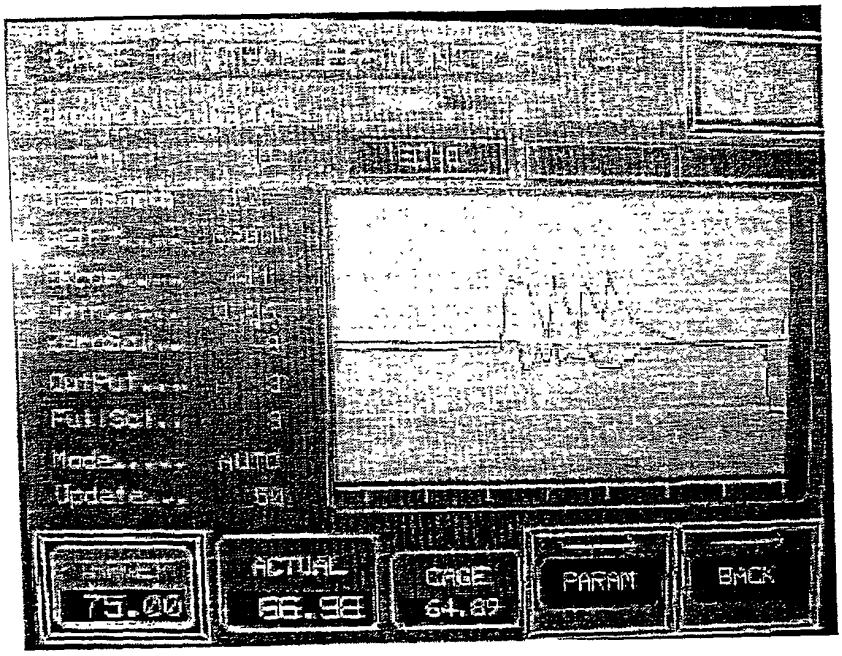


FIGURE 50

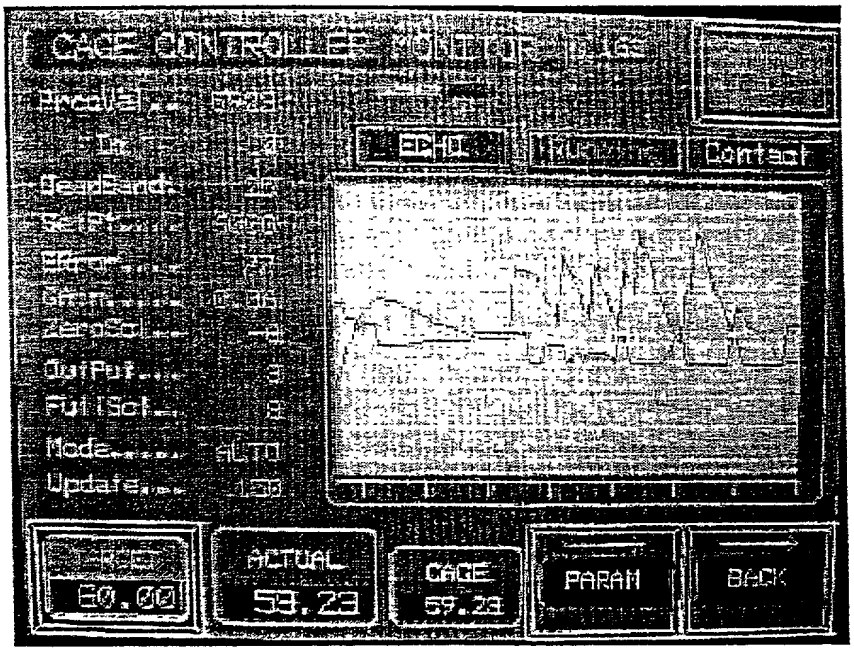


FIGURE 51

5,825,664 10/20/98

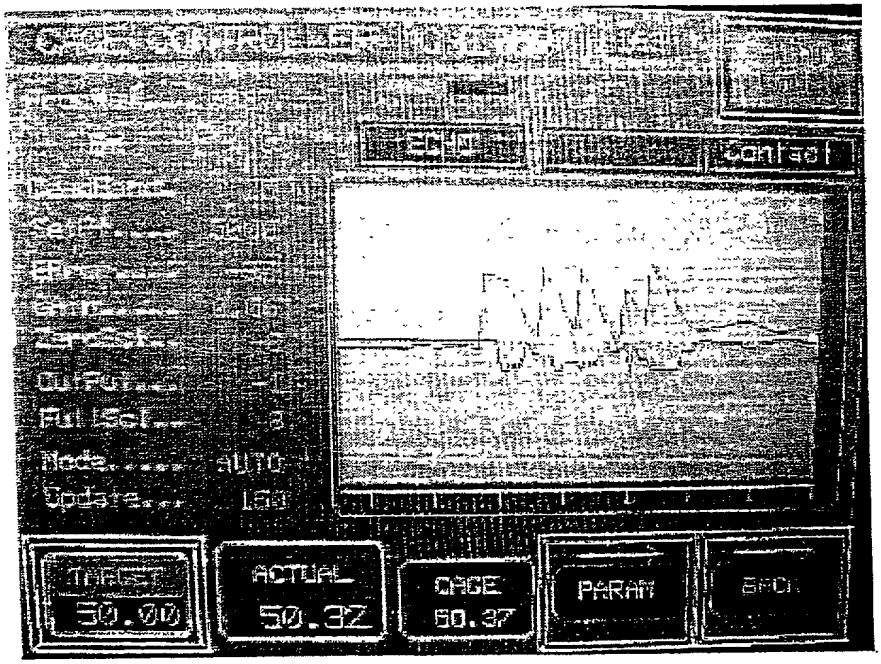


FIGURE 52

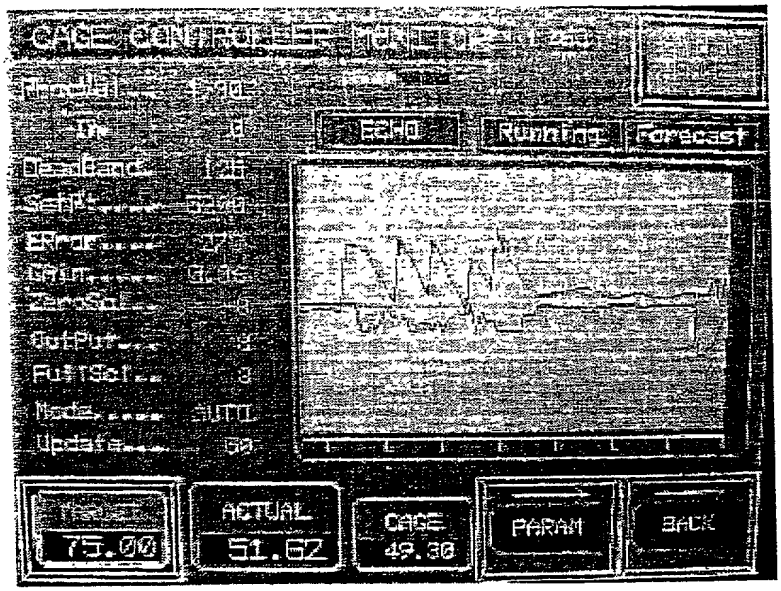


FIGURE 53